8520A/AS-1

Digital Multimeter

Instruction Manual

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SCOPE

This document supplements and thereby modifies the 8520A Operator Manual and the 8520A Service Manual to cover the operation and maintenance of the Model 8520A/AS-1 Digital Multimeter. Supplemental data is presented in the form of additions, deletions, and changes. The document follows the same sequential arrangement (by section and paragraph) as that of the manuals it modifies. In all cases the affected data is identified using paragraph numbers, paragraph headings, table numbers, and figure numbers. Modifications to the 8520A Operator Manual are given first, followed by modifications to the 8520A Service Manual.

The 8520A Calibration Manual applies directly to the 8520A/AS-1, as does all data in the 8520A Operator Manual and 8520A Service Manual that is not affected by this addendum. Therefore, change the model number "8520A" to read "8520A/AS-1" throughout all three manuals.

OVERVIEW

The 8520A/AS-1 is functionally identical to the 8520A with one added feature: the 8520A/AS-1 is compatible with the Modular Automatic Test Equipment system control interface (MATE). MATE compatibility allows a MATE Test Executive to operate the 8520A/AS-1 as a test instrument on the IEEE Std 488-1978 interface bus using Control Interface Intermediate Language (CIIL). In addition to this feature, the 8520A/AS-1 comes equipped with Option -010 which provides additional burst memory and math programs.

The 8520A/AS-1 MATE compatibility conforms to Sperry Engineering Specification No. 2806763, "MATE System Control Interface," Specification For Use With Modular Test Equipment Systems, Revision B. To conform to this specification, the 8520A/AS-1 includes the following features:

1. Two principle modes of operation, native and CIIL.

2. A CIIL instruction set.

3. Direct Memory Access, which in CIIL mode speeds up data transmission to 120K characters per second. This figure, which meets the minimum CIIL specification of 50K characters per second, ignores the time it takes the bus controller to move handshaking lines. The 8520A/AS-1 will slow transmission to match slower bus instruments.

4. An external, rear panel BNC connector for control of an external relay.

Addendum to the 8520A Operator Manual

Table of Contents

In the Table of Contents, change the title of paragraph 8-73 to INTERFACE MESSAGES and add the following items:

SECTION	TITLE	PAGE
8-9a.	Operational Modes (Native and CIIL)	Addendum
8-15a.	NATIVE INSTRUCTION SET	Addendum
8-15b.	Introduction	Addendum
8-19a.	CIIL Reset Command	Addendum
8-62a.	CIIL INSTRUCTION SET	Addendum
8-62b.	Introduction	Addendum
8-62e.	CIIL Syntax	Addendum
8-62k.	Trigger Modes (CIIL INT and CIIL EXT)	Addendum
8-62m.	Op Codes	Addendum
8-62o.	FNC	Addendum
8-62r.	SET	Addendum
8-62z.	SRX AND SRN	Addendum
8-62ae.	RST	Addendum
8-62ag.	IST AND CNF	Addendum
8-62ai.	OPN AND CLS	Addendum
8-62ak.	STA	Addendum
8-62an.	INX	Addendum
8-62as.	FTH	Addendum
8-62au.	GNM	Addendum
8-72a.	OUTPUT FORMAT (CIIL MODE)	Addendum

List of Tables

In the List of Tables, change the title of Table 8-2 to read "Native Instruction Set" and add the following items:

TABLE	TITLE	PAGE
8-2a	CIIL Instruction Set	Addendum
8-2b	CIIL Syntax	Addendum
8-2c.	CIIL Mode Error Messages	Addendum

Section 1
Introduction and Specifications

1-4. THE 8520A/AS-1 DIGITAL MULTIMETER

Add the following paragraph after paragraph 1-5:

1-5a. The 8520A/AS-1 has two principle modes of operation, native and CIIL. The CIIL mode allows the 8520A/AS-1 to operate as a test-station instrument in a MATE system. The differences between the two modes are apparent only in remote operation except for the action of the RESET button. The 8520A/AS-1 is in the CIIL mode at power-up.

1-9. OPTIONS AND ACCESSORIES

Change paragraph 1-10 to read:

1-10. The 8520A/AS-1 is provided with Option -010 as standard equipment. This is a software option which provides an additional seven math programs (#8 through #14) and an additional 350 locations of burst memory. There are no other options. The accessories available for use with the 8520A are listed in Table 1-1. When the 8520A/AS-1 is used as a test-station instrument in the MATE system, the rear-panel analog inputs should also be connected to an external relay (not shown).

1-11. SPECIFICATIONS

Add to Table 1-2 under GENERAL:

MATE COMPATIBILITY: Sperry Engineering Specification No. 2806763, "MATE System Control Interface," Specification For Use With Modular Test Equipment Systems, Revision B.

SELF TEST ACTIVE: TTL compatible (HIGH: $>$ 2.4V; 400 μA maximum current. LOW: $<$ 0.5V; 12 mA maximum current).

Section 3
Installation and Maintenance

3-9. IEEE-488 Address Switch Setting

In paragraph 3-10, change the description of the INSTR ADDRESS switches to read as follows:

1. INSTR ADDRESS: These five switches are used to select the IEEE-488 address of the 8520A/AS-1. Table 3-3 shows the position of switches for each possible address. When the address is changed with line power ON, the RESET button must be pushed in order for the change to be implemented.

Section 4
Familiarization

4-3. LOCATION OF CONTROLS, CONNECTORS, AND INDICATORS

Change Figure 4-2 to agree with Figure 4-2 of this addendum. Add the following entry to Table 4-2:

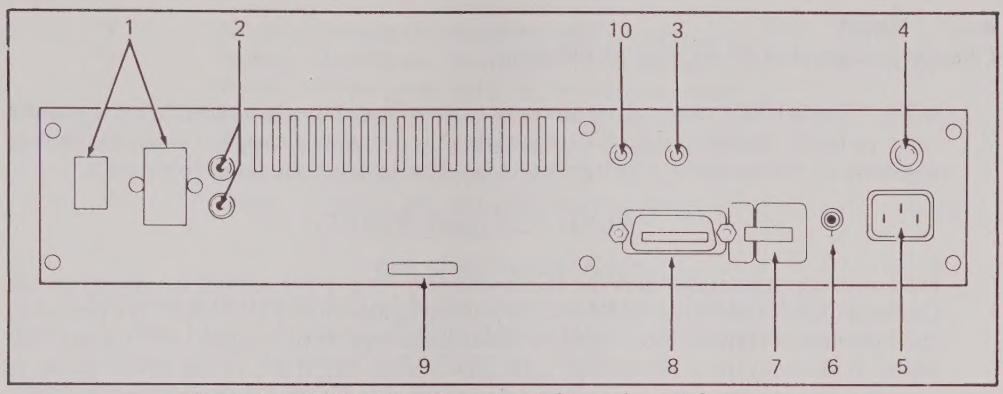


Figure 4-2. 8520A/AS-1 Rear Panel Controls and Connectors

Add the following entry to Table 4-2:

REF. NO.	NAME	FUNCTION
10	SELF TEST ACTIVE	Supplies control signal for external relay.

4-7. Power on/Off

Change paragraph 4-8 to read:

4-8. The POWER switch not only connects or disconnects line power to the instrument but, on power-up, causes the instrument to display model number, state the IEEE-488 address, initialize the math programs, and initialize the instrument to the CIIL mode and the CIIL default settings. Default settings are set-ups that the microprocessor automatically places in effect when the instrument is initialized. (CIIL default settings are shown in Table 5-3a. See paragraph 5-7 in the addendum for additional information on defaults.) When the POWER switch is pushed from the OFF position to the ON position, the instrument displays:

8520A/AS1

for 1 second. The instrument then displays the IEEE-488 address of the instrument for 1 second. For example, if the IEEE-488 ADDRESS switches on the rear panel are set to select an address of 2, the instrument displays:

IEEE = 02

Then the instrument establishes the following power-on default set-up:

CIIL mode
CIIL default settings:
Function: Volts ac (VAC in right display)
Range: 650V
Filter: 100 ms
Trigger: external (autotrigger off) (Note 1)
Trigger mode: CIIL INT
(See Table 5-3a for more information)
Math programs initialized: All variables cleared from memory, all programmable constants set to predetermined values, no programs selected, SHIFT LED off.

Note:

1. While in the CIIL mode and in local operation, autotrigger is on. Once remote operation is began, autotrigger is off.

4-17. Reset

Change paragraph 4-18 to read as follows:

4-18. The RESET control performs two functions, depending whether it is pushed once or twice. Pushing RESET once clears the variable stored in the accumulating registers of the selected math program(s). The instrument then displays:

PUSH RST (push RESET)

for 1 second; next, it displays the IEEE-488 address for one second and then resume the interrupted operation. If RESET is pushed again while PUSH RST is displayed, the instrument returns to one of two default settings. If the 8520A/AS-1 is in CIIL mode, it assumes the CIIL default settings (Table 5-3a); if it is in the native mode, it assumes the native default settings (also shown in Table 5-3a). Pushing RESET twice also puts the math programs out of use and turns off the SHIFT LED, but does not affect programmed constants.

Section 5
Operating Notes

5-1. INTRODUCTION

WARNING

TO AVOID SHOCK HAZARD OR EQUIPMENT DAMAGE, DO NOT APPLY INPUT POTENTIALS THAT EXCEED THE INPUT OVERLOAD LIMITS.

Add the following entry to Table 5-1:

TERMINALS	MAXIMUM INPUT
SELF TEST ACTIVE	30V Peak

5-5. ERROR CODES

Add the following to the end of paragraph 5-6:

Some error conditions which occur in remote operation do not result in a displayed message. In remote operation in CIIL mode, an abbreviated version of the Explanation is loaded in the output buffer as part of any error message.

Add the following items to Table 5-2 on page 5-2:

ERROR	DISPLAY	EXPLANATION
19	None	Direct Memory Access self test error
S1	None	Invalid command syntax
S2	None	Invalid command sequence
S3	None	Max-time = TRUE
S4	None	Commanded range exceeds instrument range
S5	None	Commanded gate width exceeds filter time constant
T0	None	Analog self test error: 1000V dc zero
T1	None	Analog self test error: 100V dc zero
T2	None	Analog self test error: 100 mV zero
T3	None	Analog self test error: 10V dc gain
T4	None	Analog self test error: 1000V dc gain

T5	None	Analog self test error: 100V dc gain
T6	None	Analog self test error: 100 mV dc gain
T7	None	Analog self test error: 10 megohm range
TC	None	Analog self test error: 1V ac gain
TD	None	Analog self test error: 10V ac gain
TE	None	Analog self test error: 100V ac gain
TF	None	Analog self test error: 650V ac gain

CIIL ERROR RESPONSES

F07DMM (DEV): HIGH VOLTAGE PRESENT WITH OHMS FCN SELECTED
F07DMM (DEV): SYNTAX ERROR DURING REMOTE OPERATION
F07DMM (DEV): NUMERIC OR REGISTER OVERFLOW
F07DMM (DEV): INVALID USE OF A CONTROL
F07DMM (DEV): CANNOT INCREASE FILTER IN ASYNC READING RATE
F07DMM (DEV): ZERO CANNOT BE SELECTED WITH VAC OR VA+D FCN
F07DMM (DEV): IEEE 488 INPUT BUFFER OVERFLOW
F07DMM (DEV): EXT. REF. INPUT >16.5V WITH PGM. #3 SELECTED
F07DMM (DEV): 0.5VDC DIFF., EXT. REF. HI & LO TERM, PGM #3
F00DMM (DEV): NORMAL INPUT OVERRANGE
F07DMM (DEV): IMPROPER ECHO FROM A/D MICROPROCESSOR
F07DMM (DEV): READING RATE TOO FAST FOR FILTER AND/OR PGM
F07DMM (DEV): ROM CHECKSUM ERROR
F07DMM (DEV): RAM DOES NOT CHECK OUT
F07DMM (DEV): CANNOT DETERMINE LINE FREQUENCY AT POWER ON
F07DMM (DEV): SYNC FAILURE BETWEEN MICROPROCESSOR AND A/D
F07DMM (DEV): V/OHM IN TERM NOT OPEN, ANALOG TEST, PGM
F07DMM (DEV): DMA SELF TEST ERROR
F07DMM (DEV): ERROR WHILE MEASURING VOLTS FOR OHMS CHANGE
F07DMM (DEV): TIME ERROR, INCORRECT RESPONSE FROM A/D
F07DMM (DEV): RESYNC ERROR: INSTRUMENT CONTROLLER TO A/D
F07DMM (DEV): OHMS REFERENCE ERROR
F07DMM (DEV): NO A/D RESP. TO MICROPR. WITHIN TIME LIMITS
F07DMM (DEV): MICROPROCESSOR DETECTS PARITY ERROR
F07DMM (DEV): MICROPROCESSOR DETECTS OVERRUN ERROR
F07DMM (DEV): PARITY AND OVERRUN ERRORS (CODES 31 AND 32)
F07DMM (DEV): PARITY AND FRAMING ERRORS (CODES 31 AND 34)
F07DMM (DEV): OVERRUN AND FRAMING ERRORS (CODES 32 AND 34)
F07DMM (DEV): PARITY, OVERRUN, & FRAMING ERRORS (31,32,34)
F07DMM (DEV): UNDEFINED INTERRUPT AT A/D
F07DMM (DEV): ANALOG INTERRUPT ACTIVATED
F07DMM (DEV): PARITY, OVERRUN, OR FRAMING ERROR AT A/D
F07DMM (DEV): ILLEGAL COMMAND AT A/D
F07DMM (MOD): INVALID COMMAND SYNTAX
F07DMM (MOD): INVALID COMMAND SEQUENCE
F06DMM (MOD): MAX-TIME = TRUE
F00DMM (MOD): COMMANDED RANGE EXCEEDS INSTRUMENT RANGE
F00DMM (MOD): COMMANDED GATE WIDTH EXCEEDS FILTER TC'S
F01DMM (MOD): COMMANDED RANGE EXCEEDS INSTRUMENT RANGE
F07DMM (DEV): ANALOG SELF TEST ERROR: 1000V DC ZERO
F07DMM (DEV): ANALOG SELF TEST ERROR: 100V DC ZERO
F07DMM (DEV): ANALOG SELF TEST ERROR: 100mV DC ZERO
F07DMM (DEV): ANALOG SELF TEST ERROR: 10V DC GAIN
F07DMM (DEV): ANALOG SELF TEST ERROR: 1000V DC GAIN
F07DMM (DEV): ANALOG SELF TEST ERROR: 100V DC GAIN

F07DMM (DEV): ANALOG SELF TEST ERROR: 100mV DC GAIN
F07DMM (DEV): ANALOG SELF TEST ERROR: 10M OHM RANGE
F07DMM (DEV): ANALOG SELF TEST ERROR: 1V AC GAIN
F07DMM (DEV): ANALOG SELF TEST ERROR: 10V AC GAIN
F07DMM (DEV): ANALOG SELF TEST ERROR: 100V AC GAIN
F07DMM (DEV): ANALOG SELF TEST ERROR: 650V AC GAIN

Add the following items to Table 5-2 on page 5-4:

29. Error S1 is generated when the user sends an invalid CIIL command string. A CIIL command string may be invalid for any of the following reasons:

a. Unrecognized Op Code in CIIL mode.

b. Invalid noun, noun modifier, measurement characteristic, or channel identification (channel-id) in respective fields of commands where these fields are not ignored.

c. Missing noun, noun modifier, measurement characteristic, or channel-id in commands where these fields are not ignored.

d. Value field of SRX or SRN command is not an integer, decimal, or scientific-notation number, or the AUTO command.

e. Value field of SRX or SRN command absent.

f. Illegal combination FNC DCS VRMS or FNC ACS ACCP.

If a command string contains correct setup commands and an error, and if the setup commands come prior to the error, the setup commands are executed with the next command string. If a command string contains correct setup commands, and if the setup commands come after the error, the setup commands are discarded. (Each command string is terminated by a Line Feed character.)

30. Error S2 is generated when the remote command SET, SRX, or SRN is not preceded by a FNC command.

31. Error S3 is generated when the BNC trigger is armed by a "!" command but a trigger fails to occur within the time period called Max-time. Max-time is set by SET MAXT or equivalent command, and has a default value of 3 seconds. When this error occurs, the BNC trigger becomes disarmed.

32. Error S4 is generated when a commanded range exceeds the highest measurement range of the instrument.

33. Error S5 is generated when a commanded gate width exceeds the longest available filter time constant of the instrument.

34. Errors T0 through TF are generated when the analog self test finds errors in the indicated zero or gain.

5-7. DEFAULTS

Change the last sentence in paragraph 5-8 to read as follows, deleting the initial conditions listed after paragraph 5-8.

The CIIL and native default settings referred to in Table 5-3 are shown in Table 5-3a. Default units for the CIIL and native commands, and responses are volts, ohms, or seconds.

Change Table 5-3 to read as follows:

Table 5-3. Defaults

EVENT	CLEAR VARIABLES FOR SELECTED PROGRAMS?	RESET MATH PROGRAM CONSTANTS TO PREDETERMINED VALUES?	PLACE IN DEFAULT SETTINGS?	SELECT OPERATING MODE?
Push POWER to ON	Yes	Yes	Yes (CIIL)	Yes (CIIL)
Push RESET once	Yes	No	No	No
Push RESET twice	Yes	No	Yes (note 1)	No
Remote commands:				
*	No (note 2)	No	Yes (native)	No
#	No (note 2)	No	Yes (CIIL)	Yes (CIIL)
IFC	No (note 2)	No	No	No
SDC	No (note 2)	No	Yes (CIIL)	Yes (CIIL)
DCL	No (note 2)	No	Yes (CIIL)	Yes (CIIL)
GAL	No	No	No	Yes (native)

NOTES: 1. If 8520A/AS-1 is in CIIL mode, forces CIIL default settings. If 8520A/AS-1 is in native mode, forces native default settings.

2. Turns programs off. Variables are cleared when math programs are put "IN USE" (native command M1).

Add Table 5-3a after Table 5-3:

Table 5-3a. Default Settings

CIIL DEFAULT SETTINGS		NATIVE DEFAULT SETTINGS	
Setting	Equiv. Native Command	Setting	Equiv. Native Command
AC function	VA	VDC function	V
650V range	R4	100V range	R3
100 ms filter	F3	500 ms filter	F5
2 readings/sec (@60 Hz)	D8	2 readings/sec (@60 Hz)	D8
Math programs off	M0	Math programs off	M0
No programs selected	P0	No programs selected	P0
Internal autotrigger off	T1	Internal autotrigger on	T0
Front panel enabled	N1	Front panel enabled	N1
Filter timeout enabled	N2	Filter timeout enabled	N2
LF enabled	N3	LF enabled	N3
ASCII output format	N4	ASCII output format	N4
Normal reading rate	N5	Normal reading rate	N5
EOI disabled	I6	EOI enabled	N6
Reading transfer locked	N7	Reading transfer locked	N7
Service requests disabled	S0000	Service requests disabled	S0000
External relay open	I8	External relay closed	N8
CIIL INT trig mode	none	(N8 not forced by pushing	
Max-time = 3 seconds	none	RESET twice in native mode)	

5-11. BURST TRIGGER

For clarity, in paragraph 5-12 change the third and fourth sentences to read as follows:

> If the polarity is positive, the 8520A/AS-1 takes and stores the designated number of measurements and then go to external trigger (arming the BNC trigger). If the polarity of burst size is negative, the 8520A/AS-1 takes and stores one reading for each BNC trigger.

In paragraph 5-13, delete the third sentence.

5-20A. AC COMPONENT MEASUREMENT

Add the following paragraph after paragraph 5-20 in the 8520A Operator Manual.

> When measuring the AC component of an AC + DC signal, function FNC DCS ACCP should be used. The 8520A/AS-1 causes a delay after receiving the CIIL command INX ACCP to allow more settling time for the internal AC to DC converter.
>
> CIIL External (BNC) triggers which occur during the 8520A/AS-1 delay period causes a measurement to occur after the delay period is over. The duration of the ACCP delay plus other instrument delays are reported via the IEEE-488 Bus after an INX ACCP is sent (see the paragraph on the OP CODE INX). The IEEE-488 interface message GET should not be used with ac component measurements, unless it is sent after the total delay time has elapsed.
>
> For AC+DC peak voltages of greater than 50 volts using the 10 VAC range or greater is recommended. To allow the input to settle completely and measure only the AC component, extra delays may have to be added by the user, depending on the magnitude of the DC components and the measurement accuracy desired.

Section 6
Local Operation

6-7. OPERATION AS A DC VOLTMETER

In Figure 6-1, delete the HINT. Pushing the RESET button twice in the native mode selects the 100V range; pushing it twice in the CIIL mode selects the 650V ac range.

Section 7
Math Programs

Add to the Table of Contents on page 7-1:

SECTION	TITLE	PAGE
7P	Math Program #15 - CLOSE EXTERNAL RELAY	Addendum

Section 7a
Math Program #1 - TEST

Change Table 7A-1 to read as follows:

Table 7A-1. Analog Test Limits

SUB-TEST NUMBER	NAME	LIMITS	
		MAXIMUM	MINIMUM
01	1000V dc Zero Check	-0.000347	+0.000347
02	100V dc Zero Check	-0.0005	+0.0005
03	100mV dc Zero Check	-0.0015	+0.0015
04	10V dc Gain Check	+6.4800	+6.5200
05	1000V dc Gain Check	+0.0962	+0.0982
06	100V dc Gain Check	+0.7759	+0.7791
07	100mV dc Gain Check	+6.2091	+6.2311
08	10 MOhm Range Check	+4.4604	+4.5052
13	1V ac Gain Check	+9.4186	+10.2000
14	10V ac Gain Check	+4.4146	+4.7100
15	100V ac Gain Check	+0.5061	+0.6200
16	650V ac Gain Check	+0.04390	+0.0961

Add the following section (Section 7P) after Section 7N. (There is no section 7O.)

Section 7P
Math Program #15
CLOSE EXTERNAL RELAY

7P-1. INTRODUCTION

7P-2 Math program #15 serves to close an external relay during local operation (i.e., from the front panel). The program causes the output of the SELF TEST ACTIVE rear panel terminal to go high. The external relay is used when the 8520A/AS-1 is connected to a MATE system.

7P-3. OPERATION

7P-4. Use the following procedure to implement this program:

1. Push SHIFT so that the SHIFT LED is on. The 8520A/AS-1 displays:

   "?" NMBR

2. Select math program #15 as follows:

   a. Push 1 and then 5. The 8520A/AS-1 displays:

      15 NMBR

   b. Push PROGRAM SELECTION. The contacts of the external relay closes and the 8520A/AS-1 briefly displays:

      15 = RELY

Section 8
IEEE-488 (Remote Operation)

8-1. INTRODUCTION

Add the following paragraph after paragraph 8-4:

8-4a. The 8520A/AS-1 has two principle modes of operation, native and CIIL, and two sets of device-dependent messages (native instructions and CIIL instructions). The operational mode selects the set of commands to which the 8520A/AS-1 will respond, and determines the output format.

Add the following sentence to the end of paragraph 8-5.

However, a tab or ASCII space must be inserted between all CIIL command fields (including Op Codes, nouns, values, etc.).

Add paragraph 8-5a and change paragraphs 8-6 through 8-8 to read as follows:

8-5a. When the 8520A/AS-1 generates output data, the data is loaded into an output buffer. The controller can then read this data one byte at a time when it addresses the 8520A/AS-1 as a Talker.

8-6. In native mode, output messages can be transmitted in either ASCII or binary. The format is selected by remote commands.

8-7. Instructions may be combined into a command line, the entire line terminated with a Line Feed character (LF). The instructions are held in a command buffer until the LF is read. They are then processed in the sequence in which they were entered. The maximum length of a command line in native mode is 63 characters; in CIIL mode it is 131 characters. (These numbers include terminators.)

8-8. A command line of native instructions may contain several command strings, each separated by a terminator command. When LF is received, each command string is executed in turn. If two or more instructions deal with the same item (e.g., two function instructions or two reading rate instructions), both are executed; however, the last one determines the final state of the instrument. Immediate characters are processed before the LF is received.

Add the following paragraphs after paragraph 8-9:

8-9a. Operational Modes (Native and CIIL)

8-9b. The 8520A/AS-1 has two principle modes of operation, native and CIIL. The 8520A/AS-1 powers-up in CIIL mode. The operational mode can be changed only using remote commands.

8-9c. In native mode, the 8520A/AS-1 responds to the native instruction set listed in Table 8-2 and to the CIIL instruction set in Table 8-2a. However, CIIL and native commands may not be mixed within the same command line (i.e., they must be separated by a Line Feed). Output data is in native format (defined in paragraph 8-63).

8-9d. In CIIL mode, the 8520A/AS-1 responds only to the CIIL instruction set listed in Table 8-2a. Any other device-dependent messages are treated as syntax errors. Output data is in CIIL format (defined in paragraph 8-72a).

Change the title of Table 8-2 to "Native Instruction Set". In the same table, under the headings TRIGGER, IMMEDIATE CHARACTERS, and MISC CONTROL, change the commands to read as follows, adding the CIIL RESET COMMAND:

TRIGGER

T0 Internal autotrigger on
T1 Internal autotrigger off (external trigger enabled)

IMMEDIATE CHARACTERS

* Reset to native default settings and set EOI.

% Halt (forces 8520A/AS-1 to read command buffer and clear output buffer). Sets EOI if enabled.

& Clear rsv bit in serial poll

Note: * and % each clear the output buffer except for one ASCII space.

CIIL RESET COMMAND

Reset to CIIL default settings and CIIL mode

MISC CONTROL

x = N or I (i.e., N1 or I1)

x1	Front panel on/off	x5	Normal/high speed output
x2	Filter timeout on/off	x6	EOI enabled/disabled
x3	Line Feed yes/no	x7	Lock/unlock reading transfer
x4	ASCII/binary output	x8	External relay closed/open

Also in Table 8-2, add the following note under the FILTER commands:

Note: For VAC and AC+DC functions, the following filter time constants must be used for the 8520A/AS-1 to meet the stated specifications. The 500 ms and 1000 ms filters may be used for all measurements.

INPUT FREQUENCY	FILTER
40 Hz to 350 Hz	500 ms minimum
350 Hz to 400 Hz	200 ms minimum
400 Hz to 1 MHz	100 ms minimum

Filter selected must be $\geq$ 200 ms to meet specifications for DC Volts, and $\geq$ 500 ms for 10Ω to 10kΩ ranges.

Insert Table 8-2a:

Table 8-2a. CIIL Instruction Set

OP CODE	VALID OPERANDS	EFFECT	EQUIVALENT NATIVE COMMAND
FNC	DCS VOLT ⟨channel-id⟩	Selects VDC function	V,
	DCS ACCP ⟨channel-id⟩	Selects VAC function	VA,
	DCS ZERV ⟨channel-id⟩	Selects VDC function	V,
	ACS VOLT ⟨channel-id⟩	Selects VAC function	VA,
	ACS VRMS ⟨channel-id⟩	Selects VAC function	VA,
	IMP RESI ⟨channel-id⟩	Selects 2-wire ohms function	Z2,
	IMP ZERO ⟨channel-id⟩	Selects 2-wire ohms function	Z2,

Table 8-2a. CIIL Instruction Set (cont)

OP CODE	VALID OPERANDS	EFFECT	EQUIVALENT NATIVE COMMAND
SET	TRSC INT	Selects CIIL INT mode	None
	TRSC EXT	Selects CIIL EXT mode	None
	DCPL	Selects AC+DC function (see note 1)	VC, (note 1)
	ACPL	Ignored	None
	TWOW	Selects 2-wire ohms function (see note 2)	Z2, (note 2)
	FORW	Selects 4-wire ohms function (see note 2)	Z4, (note 2)
	GAWD ⟨value⟩	Selects filter (see note page 4)	Fn,
	MAXT ⟨value⟩	Sets Max-time = <value>	None
	VOLT ⟨value or AUTO⟩	Selects range	Rn,
	VRMS ⟨value or AUTO⟩	Selects range	Rn,
	ACCP ⟨value or AUTO⟩	Selects range	Rn,
	RESI ⟨value or AUTO⟩	Selects range	Rn,
	ZERO ⟨value or AUTO⟩	Selects range	Rn,
	ZERV ⟨value or AUTO⟩	Selects range	Rn,
	⟨four characters⟩⟨value or AUTO⟩ (note 7)		(note 7)
SRX	GAWD ⟨value⟩	Selects filter (see note page 4)	Fn,
	MAXT ⟨value⟩	Sets Max-time = <value>	None
	VOLT ⟨value or AUTO⟩	Selects range	Rn,
	VRMS ⟨value or AUTO⟩	Selects range	Rn,
	ACCP ⟨value or AUTO⟩	Selects range	Rn,
	RESI ⟨value or AUTO⟩	Selects range	Rn,
	ZERO ⟨value or AUTO⟩	Selects range	Rn,
	ZERV ⟨value or AUTO⟩	Selects range	Rn,
	⟨four characters⟩⟨value or AUTO⟩ (note 7)		(note 7)
SRN	GAWD ⟨value⟩	Selects filter (see note page 4)	Fn,
	MAXT ⟨value⟩	Sets Max-time = <value>	None
	VOLT ⟨value or AUTO⟩	Selects range	Rn,
	VRMS ⟨value or AUTO⟩	Selects range	Rn,
	ACCP ⟨value or AUTO⟩	Selects range	Rn,
	RESI ⟨value or AUTO⟩	Selects range	Rn,
	ZERO ⟨value or AUTO⟩	Selects range	Rn,
	ZERV ⟨value or AUTO⟩	Selects range	Rn,
	⟨four characters⟩⟨value or AUTO⟩ (note 7)		(note 7)
INX	See note 3	In CIIL INT mode: Trigger In CIIL EXT mode: Arm BNC trigger Input. See note 4.	None
FTH	See note 3.	Loads output buffer with "⟨measurement value⟩CR LF" or error message.	None
STA	None	In native mode: Loads output buffer with Short Form Status. In CIIL mode: Loads output buffer with "⟨space⟩ CR LF" or error message.	Native mode: GS, CIIL mode: None
OPN	⟨channel-id⟩	Opens external relay	I8,
CLS	⟨channel-id⟩	Closes external relay	N8,
IST	None	Performs self test	I8M1P1MO,
CNF	None	Performs self test	I8M1P1MO,
GNM	None	Forces native mode	None
RST	⟨noun⟩ ⟨meas-char⟩ ⟨channel-id⟩	Selects CIIL mode and CIIL default settings. Opens external relay.	#,

CIIL INSTRUCTIONS (cont)

Notes:

1. SET DCPL accepted only in VAC function; otherwise ignored. SET DCPL does not force default settings.
2. SET TWOW and SET FORW do not force default settings.
3. Valid operands are VOLT, VRMS, ACCP, ZERO, ZERV, or RESI. All have identical effect.
4. In CIIL mode, INX loads output buffer with "(timeout) CR LF" or error message. In native mode, INX loads the output buffer with measurement.
5. Filter and range are selected to accomodate specified value. Value is interpreted in volts, ohms, or seconds. A ⟨UNITS⟩ command field is not allowed. If a ⟨UNITS⟩ command field is present the result is an error.
6. Some of the command fields of the RST Op Code may be omitted. See paragraph 8-62ad.
7. Some noun-modifiers do not apply to the 8520A/AS-1 and are ignored rather than causing errors.

8-12. Talk-Only Mode

Add the following sentence to the end of paragraph 8-15:

The talk-only mode forces the 8520A/AS-1 into native mode.

After paragraph 8-15, insert paragraph 8-15a and change paragraphs 8-17 and 8-18 to read as follows:

8-15a. NATIVE INSTRUCTION SET

8-15b. Introduction

8-15c. The native instruction set is shown in Table 8-2. The 8520A/AS-1 responds to native instructions only when it is in native mode. (As these are device-dependent messages, the 8520A/AS-1 must be also addressed as a Listener.) The native instruction set is explained by category in the following paragraphs.

8-16. Immediate Characters

8-17. The commands * and % are processed as soon as they are received, interrupting any measurement in progress. The native reset (*) puts the 8520A/AS-1 into the native default settings (Table 5-3a) and sets EOI. The halt command (%) forces the 8520A/AS-1 to read the command buffer and sets EOI if it is enabled.

8-18. The commands * and % also clear the output buffer except for one ASCII space. After any of these commands is sent, it is important that the controller address the 8520A/AS-1 as a Talker to remove the ASCII space. Otherwise, the 8520A/AS-1 will put the ASCII space at the beginning of the next requested output.

Add the following paragraphs after paragraph 8-19:

8-19a. CIIL Reset Command

8-19b. The CIIL reset (#) forces the 8520A/AS-1 into CIIL mode and the CIIL default settings (Table 5-3a). This is not an immediate command.

8-20. Terminator Commands

Change paragraphs 8-21, 8-22, and 8-23 to read as follows:

8-21. The three terminator commands are acted upon as soon as the instrument completes the task in progress and reads a Line Feed. They cause the instrument to execute the preceding command string stored in the command buffer.

8-22. The comma (,) terminator executes the command string in the command buffer (up to 64 characters including terminator and suffixes). There is no response or reading generated by the comma terminator since it does not trigger or arm the trigger; however, if it is preceded by a transmit command (i.e., GS, GRr, etc.) the appropriate data is placed in the output buffer.

8-23. The question mark (?) terminator returns a reading in addition to executing the command string. The command generates a trigger which loads the resulting reading into the output buffer. If the string includes a transmit command (i.e., GS, GRr, etc.), the requested data is put in the output buffer first, followed by the reading.

For clarity, in paragraph 8-24 change "transmitted to the bus" to "put in the output buffer".

8-25. Function Instructions

For clarity, change the third sentence in paragraph 8-26 to read as follows:

These are: automatic autoranging (R7) (ignored for nano-siemens); 2 readings per second (D8); 500 ms (FAST for high ohms or nano-siemens) filter settling time (F5); programs off (M0); and normal-speed output format (N5).

8-33. Program Instructions

Add the following item to Table 8-8:

CODE	TITLE	NOTE
P15	Close external relay	(blank)

8-37. Trigger Instructions

Change paragraph 8-38 to read as follows:

8-38. Instruction T0 turns on an internal, continuous autotrigger and disables all external triggers. Instruction T1 disables the autotrigger and enables two types of external triggers: the rear BNC trigger and trigger commands from the IEEE bus. (However, the BNC trigger is not armed until an exclamation point (!) terminator is received.) T1 and T0 should not be confused with the CIIL INT and CIIL EXT trigger modes.

8-39. Burst Instructions

For clarity, change the second sentence in paragraph 8-43 to read as follows:

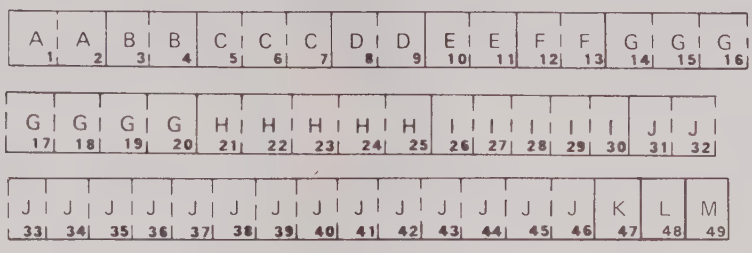
The locations scanned are neither displayed on the instrument front panel nor are they loaded into the output buffer.

8-47. Status Instructions

Replace Figure 8-1 of the Operator Manual with Figure 8-1 (Full Status Message Format) shown in this addendum.

8-52. Miscellaneous Control Instructions

Add the following paragraph after paragraph 8-60:



TOTAL CHARACTER	CHARACTER NO'S	FUNCTION
A 2	1-2	Function Code
B 2	3-4	Range Code
C 3	5-7	Reading Rate Code
D 2	8-9	Filter Code
E 2	10-11	Trigger Code
F 2	12-13	Programs In Use/Off Code
G 7	14-20	Programs Selected Codes
H 5	21-25	Burst Size
I 5	26-30	Serial Poll Codes
J 16	31-46	Miscellaneous Control Codes
K 1	47	Terminator (always a comma ",")
L 1	48	Carriage Return
M 1	49	Line Feed (program selectable)

Figure 8-1. Full Status Message Format

8-60a. Instruction 8 controls the Self Test Active signal to open and close an external relay. An external relay is connected to the analog signal path when the 8520A/AS-1 is used in a MATE system.

Insert the following paragraphs after paragraph 8-62:

8-62A. CIIL INSTRUCTION SET

8-62b. Introduction

8-62c. The Control Interface Intermediate Language (CIIL) instruction set is shown in Table 8-2a. The 8520A/AS-1 accepts these instructions in both native and CIIL mode. As these instructions are device-dependent messages, the 8520A/AS-1 must also be addressed as a Listener to receive them.

8-62d. CIIL instructions consist of an Operation Code (Op Code) followed by command fields. Command fields may include a noun, noun-modifier, measurement characteristic, channel identification (channel-id), and/or value or AUTO. A UNITS command field is not allowed. If a UNITS command field is present, it causes an error message. Subsequent paragraphs describe CIIL instructions in more detail, arranged by Op Code.

8-62e. CIIL Syntax

8-62f. The interpretation of CIIL command fields is shown in Table 8-2b. In this table, angle brackets (⟨ , ⟩) are used to separate command fields; they are not part of the instructions. When programming in CIIL, each field must be separated by one of two possible delimiters, the tab and the ASCII space.

Table 8-2b. CIIL Syntax

OP CODE	NOUN	NOUN-MODIFIER/ MEAS.-CHAR.	CHANNEL ID	VALUE
FNC	DCS	VOLT	:CH ⟨any digits⟩	Error
	DCS	ACCP	"	"
	DCS	ZERV	"	"
	ACS	VOLTS	"	"
	ACS	VRMS	"	"
	IMP	RESI	"	"
	IMP	ZERO	"	"
SET	Error	TRSC EXT	Error	Error
	"	TRSC INT	"	"
	"	DCPL	"	"
	"	ACPL	"	"
	"	TWOW	"	"
	"	FORW	"	"
	"	GAWD	"	Required
	"	MAXT	"	"
	"	VOLT	"	" note 5
	"	VRMS	"	" "
	"	ACCP	"	" "
	"	RESI	"	" "
	"	ZERO	"	" "
	"	ZERV	"	" "
		⟨Four Characters⟩	"	" "
SRX or	Error	GAWD	Error	Required
SRN	"	MAXT	"	"
	"	VOLT	"	" note 5
	"	VRMS	"	" "
	"	ACCP	"	" "
	"	RESI	"	" "
	"	ZERO	"	" "
	"	ZERV	"	"
		⟨Four Characters⟩	"	" note 5
INX	Error	Required	Error	Error
FTH	"	"	"	"
RST	(note 4)	(note 4)	(note 4)	"
IST	Error	Error	Error	Error
CNF	"	"	"	"
GAL	"	"	"	"
OPN	Error	Error	Required	Error
CLS	"	"	"	"
STA	"	"	"	"

NOTES:

1. Any other Op Codes generate errors.
2. Under each Op Code, only the nouns shown are valid; any other nouns generate errors.
3. Under each Op Code, only the noun-modifiers and measurement-characteristics shown cause the 8520A/AS-1 to respond. Others are ignored or cause errors.
4. Some fields may be omitted. See paragraph 8-62ad.
5. Value may be replaced by AUTO.

8-62g. CIIL commands may or may not be received in separate command lines. That is, the command buffer may contain multiple commands separated only a tab or ASCII space, the entire line terminated by LF. However, the commands are not executed until the LF is received. In native mode, CIIL and native commands must be separated by LF.

8-62h. Numerical quantities appearing in CIIL commands should be coded as ASCII decimals in scientific notation and should be in standard units (volts, ohms, and seconds).

8-62i. CIIL responses from the 8520A/AS-1 are ASCII characters and are terminated with Carriage Return (CR) and LF. Responses do not exceed 60 characters (plus CR and LF, if enabled).

8-62j. Trigger Modes (CIIL INT and CIIL EXT)

8-62k. The 8520A/AS-1 has two CIIL trigger modes, INT (internal) and EXT (external). The CIIL trigger mode determines how the 8520A/AS-1 responds to an INX command; that is, whether readings are triggered by a BNC trigger or directly in response to the INX command. The CIIL trigger mode is set by the commands SET TRSC INT or SET TRSC EXT. For further description, refer to the paragraph below on the Op Code INX. These modes should not be confused with the native commands T1 and T0.

8-62l. Op Codes

8-62m. The following paragraphs describe each Op Code in more detail. In these descriptions, angle brackets (⟨,⟩) are used to separate command fields; they are not part of the instructions.

8-62n. FNC

8-62o. The Op Code FNC (Function) selects the principle measurement function. The required syntax is:

FNC ⟨noun⟩ ⟨measurement characteristic⟩ ⟨channel-id⟩

Formally, the channel-id should be ":CH0". However, the channel-id may be of the form ":CH ⟨any digits⟩". FNC can be used to select the ac volts, dc volts, or 2-wire ohms function as follows:

CIIL COMMAND	FUNCTION	EQUIVALENT NATIVE COMMAND
FNC DCS VOLT :CH0	VDC	V,
FNC DCS ACCP :CH0	VAC	VA,
FNC DCS ZERV :CH0	VDC	V,
FNC ACS VOLT :CH0	VAC	VA,
FNC ACS VRMS :CH0	VAC	VA,
FNC IMP RESI :CH0	2-wire ohms	Z2,
FNC IMP ZERO :CH0	2-wire ohms	Z2,

In addition, FNC puts the 8520A/AS-1 in the CIIL INT trigger mode as a default. This mode is described in paragraph 8-62k. To select 4-wire ohms and AC+DC functions, the Op Code SET must be used.

8-62p. FNC commands force the 8520A/AS-1 into the following default settings: automatic autoranging (R7); 2 readings per second (D8); 500 ms filter settling time (F5 or F6, see paragraph 8-62u for more information); programs off (M0); and normal-speed output format (N5). In 2-wire ohms, the value of the default filter (F5) depends upon measurement range as shown in paragraph 8-62v.

8-62p.1 The measurement characteristics ZERO and ZERV are used to remove system imperfections such as offset voltages and lead resistances. During the first measurement after the function and setup commands, the 8520A/AS-1 takes a reading and stores it as an offset to be subtracted from succeeding measurements. The CIIL response to the first measurement is always 0.00000E+00 and the succeeding measurement responses are adjusted by subtracting the stored offset. The user would normally apply a short circuit to the system analog path during the first measurement, then the signal to be measured is applied during succeeding measurements. The INX command initiates a measurement. To exit the zero mode, a new function command must be sent to the 8520A/AS-1.

8-62p.2 For AC component measurement of AC+DC signals, the measurement characteristic ACCP should be used.

8-62q. SET

8-62r. The Op Code SET (Setup) selects among measurement method options. The required syntax is:

SET ⟨noun-modifier⟩ ⟨value⟩

8-62r.1 Some noun modifiers that are not listed in table 8-2a are ignored and some cause errors. Any four-character noun modifier that consists only of letters and/or digits and begins with a letter does not cause errors. For example, SET FREQ 1.0E+03 does not cause errors, and it also has no effect on the 8520A/AS-1. SET 5VAC 1.0E+3 or SET FREQU 1.0E+3 causes the 8520A/AS-1 to send an error response.

The value field (⟨value⟩) is required only for certain noun-modifiers; for others it generates an error (as shown in Table 8-2b). Valid values are positive decimal numbers in scientific notation. The value field (⟨value⟩) may be filled by AUTO with some noun-modifiers (see Table 8-2b).

8-62s. SET can be used with noun-modifiers as follows:

COMMAND	MEANING
SET TRSC EXT	Sets CIIL EXT trigger mode
SET TRSC INT	Sets CIIL INT trigger mode
SET DCPL	Sets AC+DC function if in AC function SET
SET ACPL	(ignored)
SET TWOW	Selects 2-wire ohms function
SET FORW	Selects 4-wire ohms function
SET GAWD ⟨value⟩	Selects filter
SET MAXT ⟨value⟩	Sets Max-time = value (seconds)
SET VOLT ⟨value or AUTO⟩	Sets measurement range
SET ACCP ⟨value or AUTO⟩	Sets measurement range
SET VRMS ⟨value or AUTO⟩	Sets measurement range
SET RESI ⟨value or AUTO⟩	Sets measurement range
SET ZERO ⟨value or AUTO⟩	Sets measurement range
SET ZERV ⟨value or AUTO⟩	Sets measurement range

8-62t. The commands SET TRSC EXT and SET TRSC INT select among CIIL trigger modes (described in paragraph 8-62k). The command SET DCPL puts the 8520A/AS-1 in the DC+AC volts function if the instrument is in the VAC function; otherwise the command is ignored. The command SET ACPL is always ignored. The commands SET TWOW and SET FORW select the 2-wire and 4-wire ohms functions. (The command SET TWOW is redundant with the command FNC IMP RESI :CH0.) SET commands which cause function changes do not force default settings, whereas as FNC commands do.

8-62u. The command SET GAWD value selects among the 8520A/AS-1 filter options. The available options are equivalent to native commands F0 through F6, as shown in Table 8-2. The 8520A/AS-1 automatically selects the shortest filter time constant which is greater than or equal to the specified value. If the value exceeds the instrument's longest filter time constant, the 8520A/AS-1 responds with error message S5. If ⟨value⟩ is negative, then the shortest filter time constant for the present function is selected. Note that in 2-wire and 4-wire ohms functions, changing range may also change the filter setting; this is because the value of filters F5 and F6 depends on the range as follows:

RANGE	FILTER (F5)	FILTER (F6)
100 kilohms	100 ms	1000 ms
1 megohm	200 ms	2000 ms
10 megohms	300 ms	4000 ms

Note

If the 2-wire or 4-wire ohms functions and autoranging have been selected, the filter is selected for the 10-megohms range.

Also note that for VAC and AC+DC functions, the following filter time constants must be used for the 8520A/AS-1 to meet the stated specifications. The 500 ms and 1000 ms filters may be used for all measurements.

INPUT FREQUENCY	FILTER
40 Hz to 350 Hz	500 ms minimum
350 Hz to 400 Hz	200 ms minimum
400 Hz to 1 MHz	100 ms minimum

8-62v. The commands SET VOLT ⟨value⟩, SET ZERO ⟨value⟩, SET ZERV ⟨value⟩, SET VRMS ⟨value⟩, SET ACCP ⟨value⟩, and SET RESI ⟨value⟩ select the measurement range. The 8520A/AS-1 compares the specified value with the standard measurement ranges and selects the lowest range which accommodates the value. The value is interpreted in volts or ohms depending what primary functional mode the 8520A/AS-1 is in. The 8520A/AS-1 selects only among the available fixed ranges; it can not be put in autorange using these commands. If the value exceeds the instrument's highest range, the 8520A/AS-1 responds with error message S4. In 2-wire and 4-wire ohms functions, changing range may also change the filter setting; refer to paragraph 8-62v.

8-62v.1 The commands SET VOLT AUTO, SET ZERV AUTO, SET ZERO AUTO, SET VRMS AUTO, SET ACCP AUTO, and SET RESI AUTO select autoranging.

8-62w. If other SET, SRX, or SRN range commands are received in the series of commands that proceeds a measurement, the 8520A/AS-1 selects the range which accommodates the largest of the values specified. If the AUTO command is present, autoranging is selected regardless of other range commands. The 8520A/AS-1 interprets range commands as new only after receiving a FNC command.

8-62x. The command SET MAXT ⟨value⟩ sets Max-time equal to the specified value. The value is interpreted in seconds. MAXT default is 3 seconds. (For further explanation, refer to the paragraph 8-62am, the Op Code INX.)

8-62y. SRX AND SRN

8-62z. The Op Codes SRX (Set Maximum) and SRN (Set Minimum) are interpreted identically. Either one can be used to select the measurement range or filter or specify the value of Max-time. (Refer to the paragraph 8-62am for more about Max-time.) The required syntax is:

SRX ⟨noun-modifier⟩ value

SRN ⟨noun-modifier⟩ value

Valid values are positive decimal numbers in scientific notation, or in some cases AUTO.

8-62aa. SRX and SRN can be used with noun-modifiers as follows:

COMMAND	MEANING
SRX GAWD ⟨value⟩	Selects filter
SRX MAXT ⟨value⟩	Sets Max-time = ⟨value⟩ (seconds)
SRX VOLT ⟨value or AUTO⟩	Sets measurement range
SRX ACCP ⟨value or AUTO⟩	Sets measurement range
SRX VRMS ⟨value or AUTO⟩	Sets measurement range
SRX RESI ⟨value or AUTO⟩	Sets measurement range
SRX ZERO ⟨value or AUTO⟩	Sets measurement range
SRX ZERV ⟨value or AUTO⟩	Sets measurement range
SRN GAWD ⟨value⟩	Selects filter
SRN MAXT ⟨value⟩	Sets Max-time = ⟨value⟩ (seconds)
SRN VOLT ⟨value or AUTO⟩	Sets measurement range
SRN ACCP ⟨value or AUTO⟩	Sets measurement range
SRN VRMS ⟨value or AUTO⟩	Sets measurement range
SRN RESI ⟨value or AUTO⟩	Sets measurement range
SRN ZERO ⟨value or AUTO⟩	Sets measurement range
SRN ZERV ⟨value or AUTO⟩	Sets measurement range

8-62ab. The commands SRX MAXT value and SRN MAXT value set Max-time equal to the specified value. The value is interpreted in seconds. MAXT default value is 3 seconds. (For further explanation, refer to the paragraph on the Op Code INX.)

8-62ac. SRX and SRN select the 8520A/AS-1 filter and measurement range identically to the SET Op Code. For example, SRX GAWD ⟨value⟩ and SET GAWD ⟨value⟩ both select the filter. Refer to the paragraph on the SET Op Code for further description of these commands.

8-62ad. RST

8-62ae. The Op Code (Reset) forces the 8520A/AS-1 into CIIL mode and resets the 8520A/AS-1 to the CIIL default settings (Table 5-3a). The required syntax is:

RST ⟨noun⟩ ⟨measurement-characteristic⟩ ⟨channel-id⟩

Zero to three of the right-hand fields may be present. Acceptable forms are shown in the following:

RST ⟨noun⟩ ⟨measurement characteristic⟩ ⟨channel-id⟩
RST ⟨noun⟩ ⟨measurement characteristic⟩
RST ⟨noun⟩
RST

An example is shown in the following:

RST DCS VOLT :CH0

The measurement characteristic field may contain four characters other than those listed in table 8-2a. The acceptable form of measurement characterisitc is described in paragraph 8-62r.1.

8-62af. IST AND CNF

8-62ag. The Op Codes IST (Internal Self Test) and CNF (Confidence Test) are interpreted identically. Either one causes the 8520A/AS-1 to open the external relay and perform internal self test by executing math program #1. The external relay remains open after the test is performed. These commands do not require additional fields.

8-62ah. OPN AND CLS

8-62ai. The Op Codes OPN (Open) and CLS (Close) respectively open and close the external relay. The required syntax is:

OPN ⟨channel-id⟩
CLS ⟨channel-id⟩

Formally, the appropriate channel-id is :CH0. However, the channel-id may be of the form :CH ⟨any digits⟩.

8-62aj. STA

8-62ak. The effect of the Op Code STA (Status) depends whether the 8520A/AS-1 is in CIIL or native mode. In the native mode, STA performs the equivalent of the native command GS (Get short-form status). In this case the 8520A/AS-1 responds by loading the output buffer with a two-digit error code followed by Carriage Return and (if enabled) Line Feed. (Error codes are explained in Table 5-2.)

8-62al. In the CIIL mode, STA loads the output buffer with one of the messages shown in Table 8-2c. After the message is loaded, the 8520A/AS-1 clears the short status buffer to 00.

8-62am. INX

8-62an. The effect of the Op Code INX (Initiate) depends whether the 8520A/AS-1 is in the CIIL INT or CIIL EXT trigger mode, and whether it is in native or CIIL mode. In native mode, INX is interpreted identically to the native command "?" (execute, trigger, and transmit) if in CIIL INT mode, and identically to the native command "!" (execute, arm BNC trigger, and transmit) if in CIIL EXT mode. The following paragraphs describe the effect of INX in CIIL mode. The required syntax is:

INX ⟨measurement characteristic⟩

The measurement characteristic field may be omitted. If the measurement-characteristic field is present, it must contain a valid measurement characteristic or be four characters in the form described in paragraph 8-62r.1.

8-62an.1 INX loads the output buffer with the message:

⟨timeout⟩ CR LF

where ⟨timeout⟩ is the maximum time (in seconds) which the 8520A/AS-1 takes to return a reading. The 8520A/AS-1 calculates the timeout as the integer sum of the internal instrument delay (60 ms), the gate width (set by SET GAWD or equivalent command or by default), and the value of Max-time (see the paragraph on SET, SRX, or SRN MAXT). In the function FNC DCS ACCP the internal instrument delay is approximately 10 seconds.

8-62ao. In the CIIL EXT mode, INX performs the same as the native command "!", but also starts a timer in the 8520A/AS-1. If a BNC trigger fails to occur within timeout seconds, the 8520A/AS-1 loads the output buffer with error message S3 (Max-time = TRUE).

8-62ap. In the CIIL INT mode, INX is equivalent to the native command "?".

8-62aq. Note that INX always loads the output buffer with a message. If any error condition is present, the output buffer will instead be loaded with the appropriate error message. After a message is loaded, the 8520A/AS-1 clears the short status buffer to 00.

8-62ar. FTH

8-62as. The Op Code FTH (Fetch) loads the output buffer with a measurement reading (followed by CR LF). If no reading is available, the output buffer is loaded with an ASCII space (followed by CR LF). However, if an error condition exists, the output buffer is instead loaded with one of the error messages in Table 8-2c. The required syntax is:

FTH ⟨measurement-characteristic⟩

The measurement-characteristic field may be omitted. If the measurement-characteristic field is present, it must contain a valid measurement-characteristic or be four characters in the form described in paragraph 8-62r.1.

8-62at. GAL

8-62au. The Op Code GAL (Go to alternate language) forces the 8520A/AS-1 into native mode. Note that GAL does not affect any other settings and does not force the native default settings. If the user wishes to establish the native default settings, he must send the native reset command (*). GAL requires no other fields.

Change paragraphs 8-63 and 8-64 to read as follows:

8-63. READING MESSAGE FORMATS (NATIVE MODE)

8-64. When a reading is transmitted in native mode it can be put in one of four different formats, as determined by the message format selected and the program status. The formats are ASCII, four-byte binary (standard-speed mode), two-byte binary (high-speed mode), and math program special applications. Each format is described below.

Add the following paragraphs and table after paragraph 8-72:

8-72A. OUTPUT FORMAT (CIIL MODE)

8-72b. When the 8520A/AS-1 is in CIIL mode it puts output data in CIIL format. Output data is encoded in the 7-bit ASCII character set and is terminated by Carriage Return and Line Feed. Numerical quantities are coded as ASCII decimals in scientific notation and expressed in standard units (volts, ohms, and seconds). Output data types can be summarized as follows:

1. Reading (sent in response to FTH command):

⟨measurement value⟩ CR LF

Measurement values are formatted exactly like native-mode ASCII output format (paragraph 8-65).

2. Timeout (sent in response to INX command):

⟨timeout⟩ CR LF

3. Status-Normal Response (sent in response to STA command if no errors exist, or to FTH command if no measurement exists):

⟨ASCII space⟩ CR LF

4. Error Message (sent whenever a response is requested and an error condition exists), shown in Table 8-2c.

Table 8-2c. CIIL-Mode Error Messages

ERROR MESSAGE	MEANING
⟨space CR LF⟩	No errors present
F00DMM (DEV): ⟨error-message text⟩ CR LF	Normal input overrange
F00DMM (MOD): ⟨error-message text⟩ CR LF	Positive Range command or Gate Width command exceeds instrument capability
F01DMM (MOD): ⟨error-message text⟩ CR LF	Negative Range command exceeds instrument capability
F06DMM (MOD): MAX-TIME = TRUE CR LF	BNC trigger did not occur within Max-time after INX command Instrument-related error CIIL syntax error
F07DMM (DEV): ⟨error-message text⟩ CR LF	Instrument-related error
F07DMM (MOD): ⟨error-message text⟩ CR LF	CIIL syntax error
Note: Error-message texts are completely listed in Table 5-2.	

8-72c. Error messages have priority over all other types of output data, no matter which command requests the output. For further description of the other types output data, refer to the paragraph on the Op Codes FTH, INX, and STA.

Change paragraphs 8-73 through 8-76 to read as follows:

8-73. INTERFACE MESSAGES

8-74. The 8520A/AS-1 responds to four IEEE-488 interface messages. These are Interface Clear (IFC), Device Clear (DCL), Selected Device Clear (SDC), and Group Execute Trigger (GET).

8-75. The IFC command clears any IEEE-488 Bus action in the 8520A/AS-1 and does not affect the set up from the last function and set commands.

8-75a. The 8520A/AS-1 reacts to DCL and SDC identically. The 8520A/AS-1 is forced into the power on set up described in paragraph 4-8. This set up includes CIIL mode and the CIIL default settings (Table 5-2a).

8-76. A GET instruction from the Controller triggers a reading from the 8520A/AS-1 if any of the following conditions are met: The instrument is in local, expecting a ? or ! character; in external trigger mode (T1) and not armed with a !; in external trigger mode (T1) and armed; or in internal trigger (T0). When the 8520A/AS-1 receives a GET instruction, it automatically goes into external trigger mode (T1). A delay should be programmed following a command string when a GET instruction is used so the command string can be processed. The length of the delay should vary with the length and contents of the command string. If the GET instructions are sent faster than the 8520A/AS-1 can handle them, the subsequent instructions are ignored until the instrument is again able to handle them. If the 8520A/AS-1 is in the ACCP function, see paragraph 5-20a.

8-81. PROGRAM EXAMPLES

Add the following after paragraph 8-84:

8-85. A typical CIIL-mode measurement sequence follows:

1. Controller listen-addresses 8520A/AS-1.

2. Controller sends the following commands to set up 8520A/AS-1 (the string is terminated with CR LF):

   FNC ⟨noun⟩ ⟨measurement characteristic⟩ ⟨channel-id⟩

   SET ⟨noun modifier⟩ ⟨value⟩

   SRX ⟨noun modifier⟩ ⟨value⟩

   SRN ⟨noun modifier⟩ ⟨value⟩

   SET ⟨noun modifier⟩ ⟨value⟩

   CR

   LF

3. Controller sends the following command to initiate an 8520A/AS-1 measurement:

   INX ⟨measurement characteristic⟩ CR LF

4. Controller talk-addresses 8520A/AS-1. The 8520A/AS-1 sends the normal response:

   ⟨timeout⟩ CR LF

   or sends an error message.

5. Controller listen-addresses 8520A/AS-1.

6. Controller sends the following command to fetch measurement:

   FTH ⟨measurement characteristic⟩ CR LF

7. Controller talk-addresses 8520A/AS-1. The 8520A/AS-1 sends the normal response:

⟨measurement value⟩ CR LF

or sends an error message.

8. Controller listen-addresses 8520A/AS-1 and sends the following command to reset 8520A/AS-1 to power-up state:

RST ⟨noun⟩ ⟨measurement characteristic⟩ ⟨channel-id⟩ CR LF

8-86. A typical CIIL program is given below. The example follows the measurement sequence in the previous paragraph. The commands may be viewed as a setup sequence and a read sequence, interspersed with individual commands for connecting and disconnecting the 8520A/AS-1 from the external network, resetting the 8520A/AS-1, etc. The setup sequence of commands is always within a single transmission, the function (FNC) command always being the first of these. The initiate (INX) and fetch (FTH) commands which form the read sequence are normally received in two separate transmissions; however, any intervening output request will displace the measurement reading from the output buffer.

COMMAND	COMMENT
(Listen-address 8520A/AS-1)	
FNC ACS VOLT :CH0	Beginning of setup sequence; selects VAC function.
SRX VOLT ⟨value⟩	Selects range.
SRN VOLT ⟨value⟩	Selects range (redundant with last command).
SET DCPL	Selects AC+DC function.
SET GAWD ⟨value⟩	Selects filter.
SET MAXT ⟨value⟩	Sets Max-time equal to ⟨value⟩. End of setup sequence.
(delay)	
CLS :CH0	Closes external relay.
(delay)	
INX VOLT	Beginning of read sequence; triggers measurement. (8520A/AS-1 is in CIIL INT trigger mode by default.)
(delay)	
FTH VOLT	8520A/AS-1 loads measurement value into output buffer.
(delay)	
(Talk-address 8520A/AS-1)	8520A/AS-1 puts measurement value on bus. End of read sequence.
RST ACS VOLT :CH0	Resets 8520A/AS-1 to power-up condition.

-010 Option

910-1. INTRODUCTION

Change paragraph 910-2 to read:

910-2. The 8520A/AS-1 is provided with Option -010 as standard equipment. Option -010 is a software option which gives the 8520A/AS-1 an additional seven math programs (see Table 910-1) and an additional 350 locations in burst memory. The 8520A/AS-1 is described throughout this manual with Option -010 installed.

ADDENDUM TO THE 8520A SERVICE MANUAL

Table of Contents

In the Table of Contents, add the following items under the indicated sections:

SECTION	TITLE	PAGE
1	**THEORY OF OPERATION**	3-1
	3-63a. Memory Expander Assembly	Addendum
4	**INSTRUMENT ASSEMBLY/DISASSEMBLY**	4-1
	4-3b MEMORY EXPANDER ASSEMBLY	Addendum
5	**TROUBLESHOOTING**	5-1
	5-22a. TROUBLESHOOTING WITH THE FLUKE MICRO-SYSTEM TROUBLESHOOTER	Addendum
	5-22c. Built-In Tests	Addendum
	5-22f. Troubleshooting Functions	Addendum
	5-22h. Troubleshooting With Probe and Scope	Addendum

List of Tables

Add the following two items and change the title of Table 5-2 to read "Digital PCB and Memory Expander PCB Troubleshooting".

TABLE	TITLE	PAGE
5-13a.	Address Space and ROM Signatures	Addendum
5-13b.	I/O Address Space	Addendum

Section 1
Introduction and Specifications

1-6. SPECIFICATIONS

Add to Table 1-2 under GENERAL:

MATE COMPATIBILITY: Sperry Engineering Specification No. 2806763, "MATE System Control Interface," Specification For Use With Modular Test Equipment Systems, Revision B.

SELF TEST ACTIVE: TTL compatible (HIGH: > 2.4V; 400 uA maximum current. LOW: < 0.5V; 12 mA maximum current)

Section 3
Theory of Operation

3-3. COMPONENT NUMBERING SYSTEM

Change the first sentence of paragraph 3-4 to read:

3-4. The 8520A/AS-1 is laid out on five printed circuit boards designated A1 through A5. Switches and connectors are mounted on the front and rear panels.

Change the last sentence of paragraph 3-4 to read:

Figure 3-1 shows the location of the five pcb assemblies within the instrument and the placement of the individual sections within the Digital and Analog Assemblies.

Replace Figure 3-1 in the Service Manual with Figure 3-1 shown in this addendum.

3-19. DETAILED DESCRIPTION

Change the second sentence of paragraph 3-20 to read:

The power supply circuits are described first, followed by the Display, Digital, Memory Expander, and Analog Assemblies.

3-31. DIGITAL CONTROLLER

Change paragraph 3-32 to read:

3-32. The digital controller section contains a microprocessor, a direct memory access controller (DMAC), and various control circuits. Each of these circuits is detailed in subparagraphs below. RAM and ROM for the microprocessor are contained in the Memory Expander Assembly.

3-43. Interrupt

Change the first sentence in paragraph 3-44 to read:

3-44. There are five sources of interrupts. These are: the IEEE circuit, the guard crossing circuit, the phase-locked loop circuit, the DMAC, and the IFC line from the IEEE-488 bus.

Also, add the following to the end of paragraph 44:

The DMAC is connected to the interrupt line at U5-2. The IFC interrupt is described in paragraph 3-60c. When $\overline{\text{INT VECTOR}}$ (U25-4) goes low, each interrupt signal is connected to one of the data lines (D0, D1, D3-D5, and D7) so that the microprocessor can identify the source of the interrupt.

Delete paragraphs 3-50, 3-51, 3-52, and 3-53. Add the following paragraphs after paragraph 3-60:

3-60a. Self Test Active

3-60b. The Self Test Active output signal is provided to control an external relay when the 8520A/AS-1 is used in a MATE system. (The relay opens the analog signal path when the 8520A/AS-1 is performing the self-test.) The output is set low (opening the relay) when the microprocessor sends address 40 (hex) and set high (closing the relay) when it sends address 00 (hex). CR3, CR4, TR1, and TR2 protect the output against accidental inputs between 5V and 30V peak. The Self Test Active output may be short-circuited to Vss for a maximum of 1 second.

3-60c. IFC Interrupt

3-60d. The 8520A/AS-1 software ignores the IFC interrupt. Normally, the IFC interrupt is disabled by w1 being inserted in pins 1 and 3. But, when w1 is inserted in pins 1 and 2, high-to-low transitions on the IFC line (one of the IEEE-488 bus lines) can interrupt the microprocessor. If IFC INT EN/$\overline{\text{CLR}}$ (U4-13) is high, then a falling edge on IFC causes U4-9 to be high. When U4-9 is clocked, an interrupt is set an a bit in the interrupt vector is set. The microprocessor clears the interrupt by writing data to U8 that causes IFC INT EN/CLR (U8-5) to go low. While U8-5 is low, falling IFC edges can no longer cause interrupts.

3-60e. Direct Memory Access Controller

3-60f. The direct memory access controller (DMAC) (U6) transfers bytes from RAM to the IEEE-488 transceiver (U101) and from U101 to RAM. The microprocessor configures the DMAC by addressing it and writing on control registers inside the DMAC. This is done over an internal bus which connects the microprocessor, DMAC, Memory Expander Assembly, and U101. The DMAC takes control of the internal bus only when the microprocessor enables it to do so by lowering BUSAK (U18-23). The DMAC then controls the internal bus exactly like the microprocessor controls read and write cycles. The DMAC is not used in native mode.

3-60g. The DMAC transfers data from RAM to U101 as follows: The CPU configures the DMAC. The 8520A/AS-1 is made a Talker by the IEEE-488 bus. The microprocessor finds an interrupt from U101, looks to see if output data is available, and tells the DMAC where to find the output. The DMAC then transfers data one byte at a time, releasing control of the internal bus after each byte. When the DMAC finds an ASCII Line Feed character (LF), it disables itself and sends an interrupt to the microprocessor.

3-60h. The DMAC transfers data from U101 to RAM as follows: The microprocessor configures the DMAC. U101 receives the first byte from the IEEE-488 bus and sets an interrupt. When interrupted, the microprocessor enables the DMAC. The DMAC then transfers data as fast as the IEEE-488 bus supplies it, releasing control of the internal bus after each byte. The DMAC disables itself when it finds a Line Feed character or 60-character input, and sends an interrupt to the microprocessor. The microprocessor responds by reading status registers in the DMAC. The microprocessor then initializes the DMAC for the next transfer. While the DMAC is disabled, the microprocessor can return from the interrupt and continue normal processing (taking readings, updating the display, etc.).

Add the following paragraphs after paragraph 3-63:

3-63a. Memory Expander Assembly

3-63b. The Memory Expander Assembly contains all of the RAM and ROM for the 8520A/AS-1. Address and control lines lines are decoded by U9 and U10 to select one of the EPROM or RAM chips. U18-21 ($\overline{\text{RD}}$) controls the RAM Output Enable signal. Jumpers W1 through W16 are provided for possible future design changes; these should not be altered.

Section 4
Instrument Assembly/Disassembly

Add the following paragraphs after paragraph 4-3:

4-3A. MEMORY EXPANDER ASSEMBLY

4-3b. Remove the Memory Expander Assembly from the instrument compartment using the following procedure. Prior to starting, the top cover must be removed.

1. Disconnect the two ribbon cables connecting the Memory Expander Assembly to the Digital Assembly.

2. Remove the Memory Expander Assembly by removing the four screw which hold it in place.

Change paragraphs 4-11 and 4-12 to read as follows:

4-11 FRONT PANEL DISPLAY ASSEMBLY

4-12 The Memory Expander Assembly and the front panel must be removed to gain access to the Display Assembly and its components. To reach the screws required for removal of the front panel, the top cover must be removed. Removal of the top analog guard cover is not required but removal does improve access to the screw heads.

Change paragraphs 4-17 and 4-18 to read as follows:

4-17. DIGITAL ASSEMBLY

4-18. Remove the Digital Assembly from the instrument compartment using the following procedure. Prior to starting, the top cover, the Memory Expander Assembly, the transformer, and the Transformer Assembly must be removed.

Add the following steps after step 4 under paragraph 4-18:

4a. Disconnect the two wires to the rear panel trigger connector J7, unplugging the wires from the Digital Assembly PCB.

4b. Disconnect the wire to the rear panel SELF TEST ACTIVE connector J31, unplugging the wire from the Digital Assembly PCB.

4c. Disconnect the ground wire from the Digital Assembly.

Section 5
Troubleshooting

5-1. INTRODUCTION

In paragraph 5-3, change the third sentence from the end to read as follows:

The tables cover procedures for troubleshooting the Front Panel, the Digital PCB, the Memory Expander PCB, and the Analog PCB.

Add the following paragraph after paragraph 5-3:

5-3a. This section also explains how to test the 8520A/AS using a Fluke 9000-series Micro-System Troubleshooter.

Change the title of Table 5-2 to read "Digital PCB and Memory Expander PCB Troubleshooting." In the same table, change steps 13, 14, 24, 26, 39, 41, and 43 to read as follows:

STEP NO.	ACTION	GO TO STEP FOR CORRECT RESPONSE	
		YES	NO
13	Check the following microprocessor signal test points for an active signal: TP5 $\overline{M1}$ (Output) TP8 $\overline{WAIT}$ (Input) U18-20 $\overline{IREQ}$ (Output) U18-19 $\overline{MEMREQ}$ (Output) U18-28 $\overline{RFSH}$ (Output) U18-21 $\overline{RD}$ (Output) U18-22 $\overline{WR}$ (Output)		
14	Are all points active?	16	a
24	Check U9 on the Memory Expander PCB. Repeat test #2 while checking the data and address lines of U1 through U5 on the Memory Expander PCB for an active state. Repair as required then resume at step 21.		
26	Check U10 on the Memory Expander PCB. Repeat test #2 while checking the data and address lines of U7 and U8 on the Memory Expander PCB for an active state. Repair as required then resume at step 21.		
39	Does the front panel REMOTE indicator light?	c	40
41	Does the instrument correctly respond to CIIL commands (e.g., 'RST')?	46	42
43	Is the correct address displayed?	j	44

Add the following items to the end of Table 5-2:

STEP NO.	ACTION	GO TO STEP FOR CORRECT RESPONSE	
		YES	NO
a	Is U18-25 ($\overline{\text{BUSREQ}}$) stuck at logic high (approx. +5V)?	b	15
b	Check R28 and U6. (Replacement is normally the best method of checking U6.) Repair is required, then resume at step 2.		
c	Is the SELF TEST ACTIVE output used?	d	41
d	Power the 8520A/AS-1 OFF and then ON.		
e	Is the Self Test Active output signal at a logic high (approx. +5V) (relay open)?	g	f
f	Check U2, U4, U5, TR1, TR2, CR3, and CR4. Repair as required, then resume at step e.		
g	Select program 15.		
h	Is the Self Test Active output signal at a logic low (approx. 0V) (relay closed)?	41	i
i	Check U2, U4, U5, TR1, TR2, CR3, and CR4. Repair as required, then resume at step h.		
j	Remove U6. Send a CIIL command (e.g., RST).		
k	Is TP13 (RDY) high?	m	l
l	Reinstall the original U6 and resume at step 45.		
m	Is TP12 (CE/WAIT) stuck at a logic high (approx. +5V)?	n	o
n	Check U2, U30, and U25. Repair as required. Reinstall the original U6, then resume at step 41.		
	Install a new U6.		
o	Does the 8520A/AS-1 respond correctly to CIIL commands (e.g., RST)?	46	45
p			

Add the following items to Table 5-4:

ERROR	DISPLAY	EXPLANATION
19	None	DMA (direct memory access) self-test error
S1	None	Invalid command syntax
S2	None	Invalid command sequence
S3	None	Max-time = TRUE
S4	None	Commanded range exceeds instrument range
S5	None	Commanded gate width exceeds filter time constant
T0	None	Analog self test error: 1000V dc zero
T1	None	Analog self test error: 100V dc zero
T2	None	Analog self test error: 100 mV zero
T3	None	Analog self test error: 10V dc gain
T4	None	Analog self test error: 1000V dc gain
T5	None	Analog self test error: 100V dc gain
T6	None	Analog self test error: 100 mV dc gain
T7	None	Analog self test error: 10 megohm range
TC	None	Analog self test error: 1V ac gain
TD	None	Analog self test error: 10V ac gain
TE	None	Analog self test error: 100V ac gain
TF	None	Analog self test error: 650V ac gain

Remove Figure 5-5 and add the following paragraphs after paragraph 5-22 in the 8520A Service Manual.

5-22A. TROUBLESHOOTING WITH THE FLUKE MICRO-SYSTEM TROUBLESHOOTER

5-22b. If a Fluke 9000-series Micro-System Troubleshooter is available, the Digital PCB Assembly may be tested using the Z80 CPU data and address bus control lines. Using a 9xxxx mainframe and a Z80 POD, three different modes of 9xxx testing may be applied to the Digital PCB Assembly: built-in tests, troubleshooting functions, and troubleshooting with a probe and a scope.

5-22c. Built-In Tests

5-22d. The built-in tests work mainly with what is called the kernel of the Digital PCB Assembly (the data and address bus, ROM, RAM, and CPU control and status lines). See Table 5-13a for a map of the address space and ROM signatures. Data bus lines D0-D7 and DB0-DB7 may be tested with the 9xxx BUS TEST by replacing U24 with a header on which pins are shorted in pairs (2-18, 3-17, 4-16, 5-15, 6-14, 7-13, 8-12, and 9-11) so that the buffered data bus is shorted to the ID0-ID7 bus. The Z80 POD has more drive capability than the Z80 CPU.

5-22e. If the 8520A/AS-1 works correctly with the 9xxx Z80 POD but not with the Z80 CPU chip, try replacing the 8520A/AS-1 RAM.

5-22f. Troubleshooting Functions

5-22g. The troubleshooting functions are extremely helpful for debugging problems with the chips that are I/O mapped for the CPU. See Table 5-13b for a map of the I/O address space.

5-22h. Troubleshooting With Probe and Scope

5-22i. By using the 9xxx probe in conjunction with the troubleshooting functions, bit patterns may be read (written) to devices while the probe is used to test for logic highs and lows. The probe may be synchronized with the address or data bus before data is read or written. Probing directly at device pins should indicate if the data that the Z80 POD is receiving (sending) matches the data that an I/O port or other device (RAM, ROM, etc,) is sending.

Table 5-13a. Address Space and ROM Signatures

ITEM	ADDRESS	SIGNATURE	COMMENT
ROM	0-1FFF	C87E	U1 (Memory Expander Assembly)
	2000-3FFF	7998	U2 (Memory Expander Assembly)
	4000-5FFF	B0B2	U3 (Memory Expander Assembly)
	6000-7FFF	632C	U4 (Memory Expander Assembly)
	8000-9FFF	FCA7	U5 (Memory Expander Assembly)
RAM	C000-C7FF		U7 (Memory Expander Assembly)
	C800-CFFF		U8 (Memory Expander Assembly)
I/O	0080-008F		IEEE Interface
	00C0-00CF		Main Section
NOTE: ROM information applies to Software Version 3.0.			

Table 5-13b. I/O Address Space

ADDRESS/ DATA LINE	SYSTEM FUNCTION
100C0	(INPUT) Reads Receiver Buffer Register of U26 (UART). This address location uses the entire data bus D0-D7.
100C1	(OUTPUT) Write to Transmitter Buffer Register of U26 (UART). This address location uses the data bus D0-D7.
100C2	Read error status of U26 (UART).
D7	Not used
D6	Not used
D5	Not used
D4	(INPUT) Cal Switch (0=closed, 1=opened)
D3	(INPUT) Framing Error
D2	(INPUT) Overrun Error
D1	(INPUT) Parity Error
D0	(INPUT) Transmitter Register Empty
100C3	Read interrupt vector data.
D7	(INPUT) Line Interrupt (Mark Interrupt)
D6	(INPUT) External Trigger Flag
D5	(INPUT) UART Data Received
D4	(INPUT) UART Transmitter Buffer Register
D3	(INPUT) IEEE Interrupt
D2	(INPUT) Power Failure
D1	(INPUT) IFC Interrupt
D0	(INPUT) DMA Interrupt
100C4	Write bus state enable
D7	(OUTPUT) Mark Enable: Enable Mark Interrupt
D6	(OUTPUT) External Trigger Enable
D5	(OUTPUT) UART Data-Available Enable: Enable UART Interrupt
D4	(OUTPUT) Guard Trigger Enable
D3	(OUTPUT) Line Frequency (1=400, 0=50/60 Hz)

Table 5-13b. I/O Address Space (cont)

ADDRESS/ DATA LINE	SYSTEM FUNCTION
	NOTE If the 400, 50/60 Hz signal is made high while the power line frequency is 50 or 60 Hz, then the Reset signal will "soon" be active, since the reset circuitry depends on the correct frequency on signal FLINE.
D2	(OUTPUT) Guard Mark Enable
D1	IFC Latch Enable And Clear
D0	(OUTPUT) Remote LED
100C5	DIGIT (This signal to display board)
100C6	SEGMENT (This signal to display board)
100C7	SW (This signal controls front panel display blanking)
100C8	DMA CE (Enables U6 for data to be written or read)
100C9	SOFT TRIG (Software trigger for guard trigger of a reading)
100CA to 100CF	Not used.

NOTE:

The leading 1 in the addresses (e.g., 100C0) indicates an I/O signal to the Fluke 9xxx and is not relevant to the 8520A/AS address space. Data lines are D0, D1, D2, etc.

Section 6
List of Replaceable Parts

TABLE OF CONTENTS

Add the following item to the Table of Contents:

ASSEMBLY NAME	DRAWING NO.	TABLE NO.	TABLE PAGE	FIGURE NO.	FIGURE PAGE
A5 Memory Expander PCB Assembly	8520A/AS-4093	6-6a	Addendum	6-6a	Addendum

Replace Tables 6-1 and 6-3 and Figures 6-1 and 6-3 in the manual with the corresponding tables and figures given in this addendum. Also add Table 6-6a and Figure 6-6a.

Table 6-1. 8520A/AS-1 Final Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
A	FINAL ASSEMBLY FIGURE 6-1 (8520A/AS-1-5002)						
A1	DISPLAY ASSEMBLY see 8520A Manual	516625	89536	516625	1		
A2	DIGITAL PCB ASSEMBLY see 8520A/AS-1 addendum	745547	89536	745547	1		
A3	ANALOG PCB ASSEMBLY see 8520A Manual	496836	89536	496836	1 REF		
A4	TRANSFORMER ASSEMBLY see 8520A Manual	496869	89536	496869	1 REF		
A5	MEMORY EXPANDER PCB ASSEMBLY see 8520A/AS-1 addendum	745513	89536	745513	1 REF		
F201	FUSE, SLO-BLO, 1/2 AMP	109322	71400	MDL1-2	1		5
H1	NUT, HEX, 1/4-28	110619	89536	110619	2		
H2	NUT, HEX, 4-40	147611	89536	147611	2		
H3	SCREW, PHP, 4-40 X 1/4	185918	89536	185918	10		
H4	SCREW, PHP, 6-32 X 5/16	424713	89536	424713	11		
H5	SCREW, FHP, 6-32 X 1/4 U/CUT	320093	89536	320093	12		
H6	SCREW, RHP, 6-32 X 1/4	385401	89536	385401	27		
H7	SCREW, PHP, 6-32 X 1/4	177022	89536	177022	15		
H10	SCREW, PHP, 6-32 X 1/2	177030	89536	177030	4		
H11	SCREW, SOCKET, 8-32 X 3/8	295105	89536	295105	4		
H12	SCREW, FHP, 8-32 X 3/8	320085	89536	320085	8		
H13	SCREW, FHP, 8-32 X 1/2	114355	89536	114355	8		
H14	SCREW, PHP, 8-32 X 5/8	293324	89536	293324	4		
H15	WASHER, FLAT	111054	89536	111054	2		
H16	WASHER, LOCK, 1/4	110817	89536	110817	2		
H17	WASHER, LOCK, EXT. TOOTH (w/XF1)	175943	89536	175943	1		
H18	WASHER, LOCK, INTERNAL TOOTH, #8	110320	89536	110320	4		
H20	WASHER, SPLIT LOCK, #4	147603	89536	147603	2		
H21	WASHER, LOCK, #6	403923	89536	403923	27		
H22	SCREW, PHP, 4-40 X 3/16	129882	89536	129882	2		
H23	WASHER, MYLAR	240820	89536	240820	2		
J7	BNC CABLE ASSEMBLY	660340	89536	660340	1		
J9	BINDING POST, BRASS	225623	20584	3576	1		
J10	RECEPTACLE, W/LINE FILTER	321273	05245	3EF2	1		
J31	BNC CABLE ASSEMBLY	660357	89536	660357	1		
MP1	BAIL, FULL WIDTH	231407	89536	231407	1		
MP2	BINDING HEAD	225615	20584	3575	1		
MP3	BULKHEAD, CENTER	491100	89536	491100	1		
MP4	BUTTON, GREY	472316	89536	472316	2		
MP5	CHASSIS, ANALOG ASSEMBLY	581561	89536	581561	1		
MP6	CHASSIS SIDE, LEFT	491084	89536	491084	1		
MP7	CHASSIS SIDE, RIGHT	491092	89536	491092	1		
MP10	CONNECTOR MOUNTING KIT	494773	89536	494773	1		
MP11	COVER, BOTTOM, 18" PACKAGE	491191	89536	491191	1		
MP12	COVER, BOTTOM, GUARD	490979	89536	490979	1		

Table 6-1. 8520A/AS-1 Final Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
MP13	CORNER, PLASTIC	394338	89536	394338	2		
MP14	COVER, TOP (18")	491183	89536	491183	1		
MP15	COVER, TOP-GUARD	490987	89536	490987	1		
MP16	DECAL, FRONT PANEL	745620	89536	745620	1		
MP17	TOOL, ADJUSTMENT	520825	89536	520825	1		
MP18	DECAL, SIDE TRIM	525998	89536	525998	2		
MP19	DECAL, SIDE	394379	89536	394379	4		
MP20	FOOT, BAIL STAND	292870	89536	292870	4		
MP21	FOOT, REAR PANEL	307363	89536	307363	4		
MP24	GROMMET, RUBBER	100073	83330	2149	1		
MP25	CORNER HANDLE, FRONT	394296	89536	394296	2		
MP26	INSERT, FRONT PANEL	496760	89536	496760	1		
MP27	INSULATOR, FASTENER	372342	89536	372342	6		
MP28	LENS, DISPLAY	534479	89536	534479	1		
MP29	LUG, SOLDER	101022	89536	101022	2		
MP30	PANEL, FRONT	491175	89536	491175	1		
MP31	PANEL, REAR	745604	89536	745604	1		
MP32	TRANSFORMER COVERPLATE	496893	89536	496893	1		
MP33	SPACER, INSULATED	372334	89536	372334	6		
MP34	ACTUATOR, SWITCH	502690	89536	502690	1		
MP35	SIDE, LEFT GUARD	581546	89536	581546	1		
MP36	SIDE, RIGHT GUARD	581538	89536	581538	1		
MP37	PANEL, REAR GUARD	581520	89536	581520	1		
MP38	PANEL, FRONT GUARD	581512	89536	581512	1		
MP39	CABLE CLAMP	101345	89536	101345	1		
MP40	DECAL, POWER ON/OFF	523704	89536	523704	1		
MP41	CLAMP, CABLE	165951	31827	3-4-1	1		
MP42	CABLE TIE	172080	89536	172080	2		
MP43	CLAMP, CABLE	101352	71400	5681-15	1		
MP44	DECAL, SERIALIZATION	472795	89536	472795	1		
S201	SWITCH, POWER	507871	71468	SCH.1XF.0003-01	1	1	
TM1	INSTRUCTION MANUAL 8520A/AS-1	745489	89536	745489	1		
W1	CORD SET, 3-WIRE	284174	89536	284174	1		
W2	CABLE, POWER SWITCH	496877	89536	496877	1		
W3	CABLE, REAR INPUT	496885	89536	496885	1		
XF201	FUSE HOLDER, BODY & NUT	375188	89536	375188	1		
	- CAP	460238	89536	460238	1		

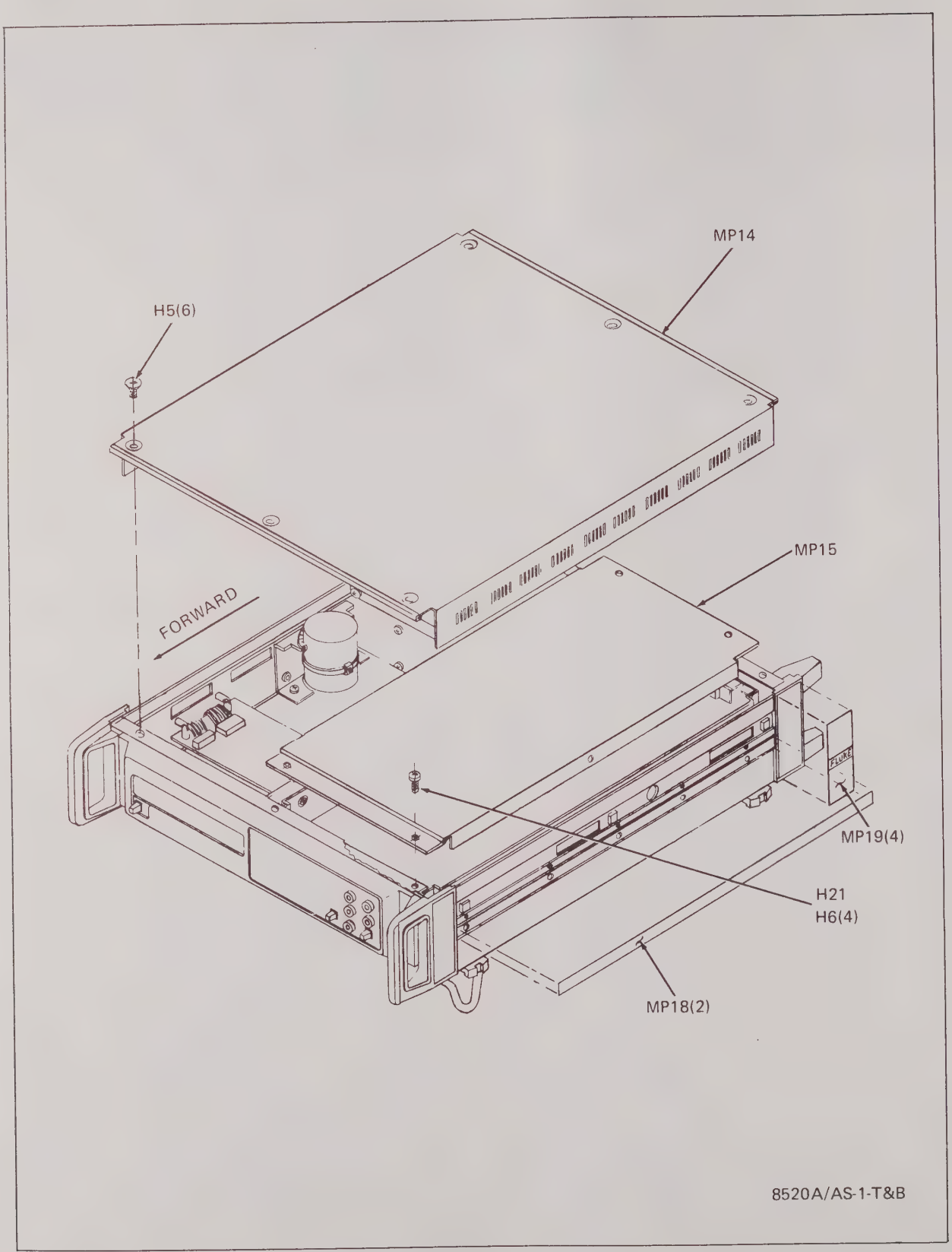


Figure 6-1. 8520A/AS-1 Final Assembly

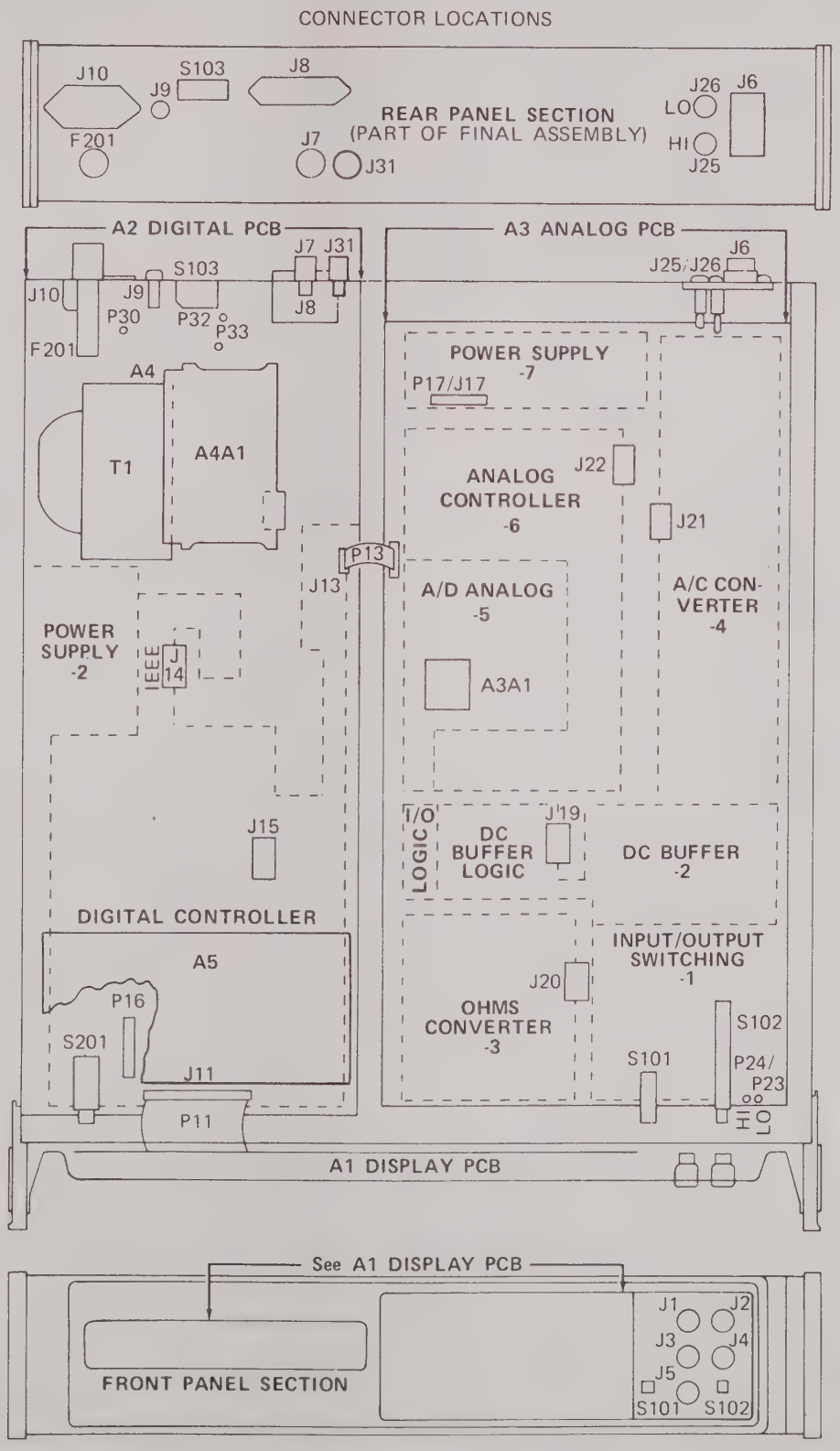


Figure 6-1. 8520A/AS-1 Final Assembly (cont)

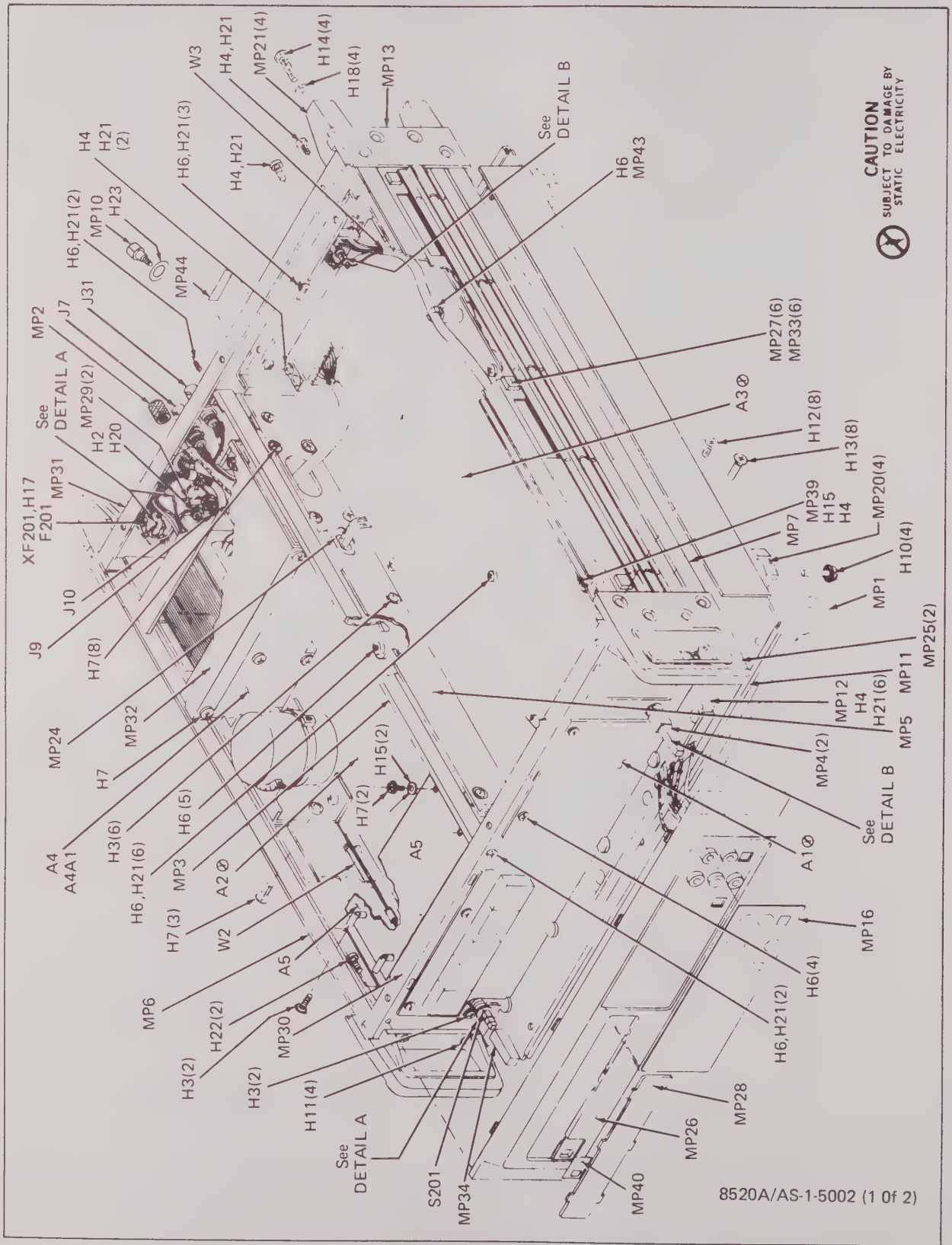
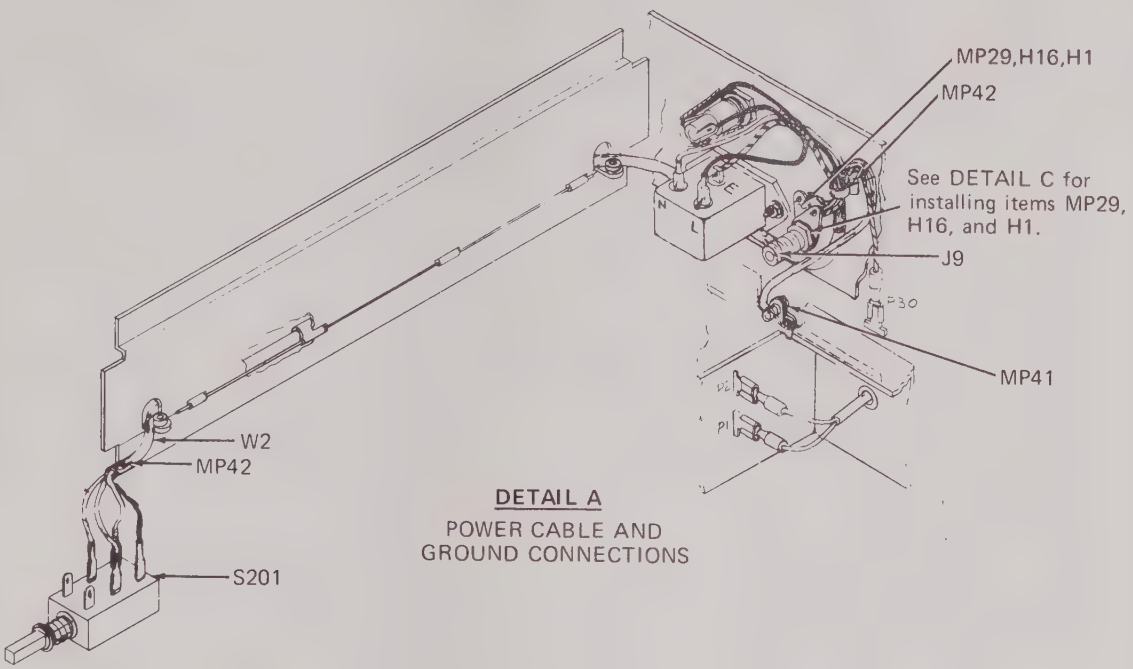
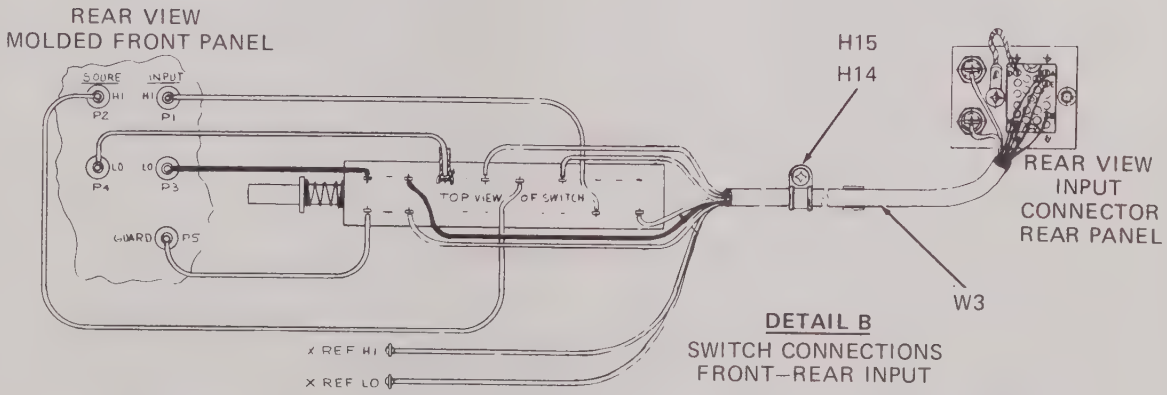


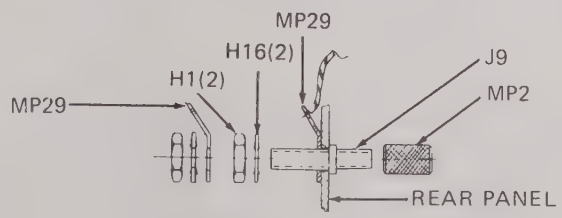
Figure 6-1. 8520A/AS-1 Final Assembly (cont)



DETAIL A
POWER CABLE AND GROUND CONNECTIONS



DETAIL B
SWITCH CONNECTIONS
FRONT–REAR INPUT



DETAIL C

8520A/AS-1-5002 (2 of 2)

Figure 6-1. 8520A/AS-1 Final Assembly (cont)

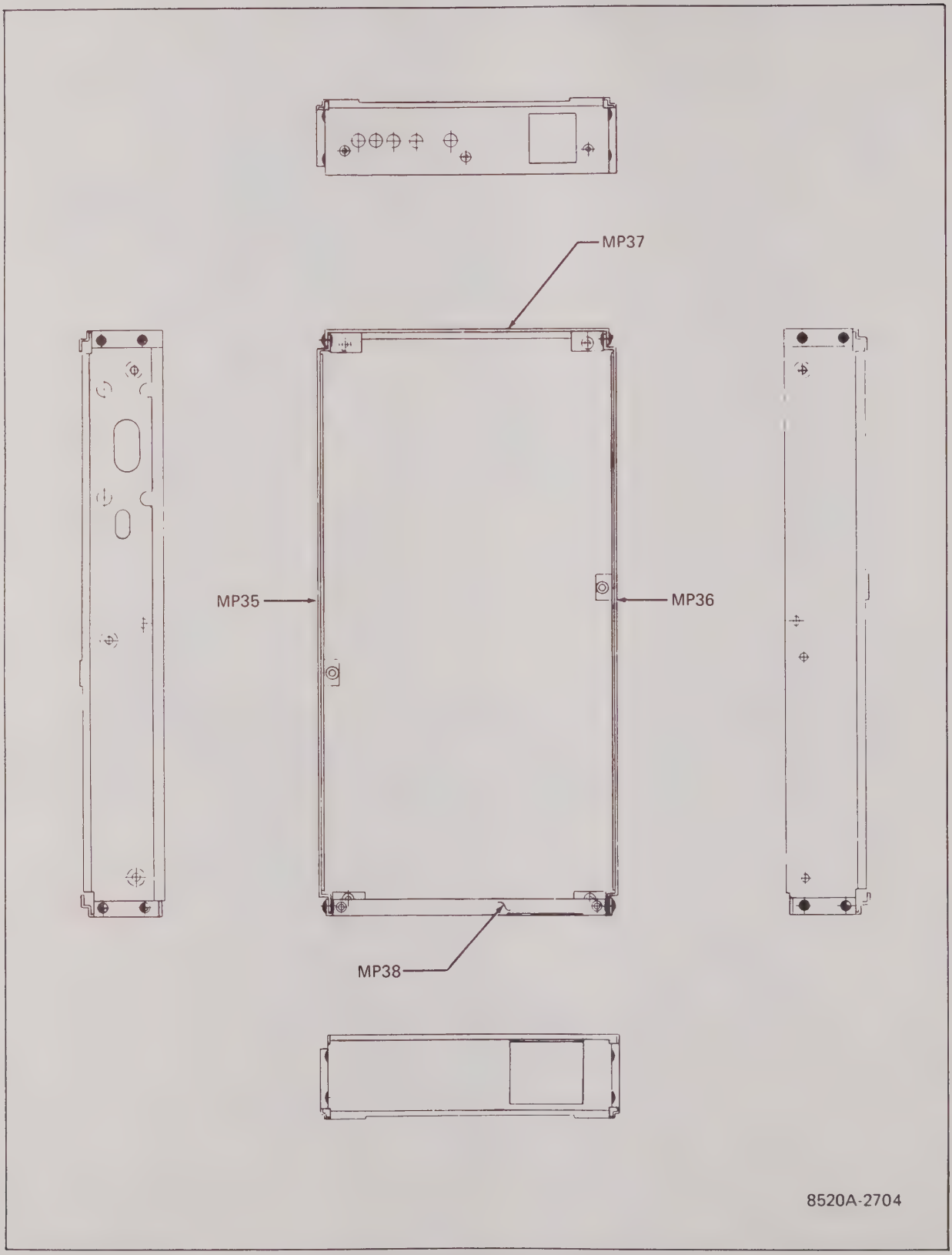


Figure 6-1. 8520A/AS-1 Final Assembly (cont)

Table 6-3. A2 Digital Controller PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
A2Ø	DIGITAL CONTROLLER PCB ASSEMBLY FIGURE 6-3 (8520A/AS-1-4020T)	745547	89536	745547	REF		
C1	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	19		
C2	CAP, TA, 150 UF +/-20%, 15V	422576	56289	196D157X0020TA1	6		
C3	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C4	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C5	CAP, TA, 150 UF +/-20%, 15V	422576	56289	196D157X0020TA1	REF		
C6	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C7	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C8	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C9	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C10	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C11	CAP, TA, 10 UF +/-20%, 10V	176214	56289	196D106X0010KA1	REF		
C12	CAP, TA, 150 UF +/-20%, 15V	422576	56289	196D157X0020TA1	REF		
C13	CAP, MICA, 47 PF +/-5%, 500V	148536	14655	CD15ED470J0	2		
C14	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C15	CAP, CER, 0.05 UF -20/+80%, 25V	148924	72982	5855-000-Y5U0-503Z	1		
C16	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C17	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C18	CAP, CER, 25,000 PF +/-20%, 100V	168435	56289	C023B101H253M	6		
C19	CAP, CER, 0.01 UF +/-20%, 100V	407361	72982	8121-A100-W5R-103M	2		
C20	CAP, TA, 1 UF +/-20%, 35V	161919	56289	196D010X0035G	4		
C21	CAP, CER, 25,000 PF +/-20%, 100V	168435	56289	C023B101H253M	REF		
C22	CAP, CER, 0.01 UF +/-20%, 100V	407361	72982	8121-A100-W5R-103M	REF		
C23	CAP, TA, 39 UF +/-20%, 6V	163915	56289	196D396X0006KA1	1		
C24	CAP, CER, 25,000 PF +/-20%, 100V	168435	56289	C023B101H253M	REF		
C25	CAP, MICA, 100 PF +/-5%, 500V	148494	14655	CD15FD101J0	2		
C26	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C27	CAP, TA, 1 UF +/-20%, 35V	161919	56289	196D010X0035G	REF		
C28	CAP, TA, 1 UF +/-20%, 35V	161919	56289	196D010X0035G	REF		
C29	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015KA1	2		
C30	CAP, TA, 1 UF +/-20%, 35V	161919	56289	196D010X0035G	REF		
C31	CAP, MICA, 100 PF +/-5%, 500V	148494	14655	CD15FD101J0	REF		
C32	CAP, MICA, 47 PF +/-5%, 500V	148536	14655	CD15ED470J0	REF		
C33	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C34	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C35	CAP, TA, 150 UF +/-20%, 15V	422576	56289	196D157X0020TA1	REF		
C101	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C102	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C103	CAP, TA, 150 UF +/-20%, 15V	422576	56289	196D157X0020TA1	REF		
C104	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C105	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C106	CAP, CER, 25,000 PF +/-20%, 100V	168435	56289	C023B101H253M	REF		
C107	CAP, CER, 25,000 PF +/-20%, 100V	168435	56289	C023B101H253M	REF		
C108	CAP, CER, 1.0 UF +/-20%, 50V	436782	72982	8131-050-601-105M	REF		
C109	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	1		
C110	CAP, CER, 1000 PF +/-20%, 100V	407361	72982	8121-A100-W5R-103M	1		
C201	CAP, ELECT, 22,000 UF +/-15%, 18V	479220	56289	32DX223G015BA2A	1		
C202	CAP, TA, 0.22 UF +/-20%, 35V	161331	56289	196D224X0035HA1	1		

Table 6-3. A2 Digital Controller PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
C203	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015KA1	REF		
C204	CAP, TA, 22 UF +/-20%, 15V	423012	56289	196D226X0015KA1	REF		
CR1	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	3	1	
CR2	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR3	DIODE, SI, RECITFIER, 1A	343491	01295	1N4002	3	1	
CR4	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR201	DIODE, LIGHT EMITTING	429555	12040	NLS5053	1	1	
CR202	DIODE, SI, RECITFIER, 1A	343491	01295	1N4002	REF		
CR203	DIODE, SI, RECITFIER, 1A	343491	01295	1N4002	REF		
H1	P-NUT, 4-40	380196	24347	KF2-440	2		
H2	SCREW, PHP, 4-40 X 5/16	335141	89536	335141	1		
H3	SCREW, PHP, 4-40 X 7/16	403782	89536	403782	1		
H4	SCREW, PHP, THD. FORMING, 5-20 X 5/16	494641	89536	494641	2		
H5	SCREW, PHP, 10-32 X 5/16	417105	89536	417105	2		
H6	WASHER, SHOULDER	436386	86928	5607-45	1		
J8	CONNECTOR, RECEPTACLE	485763	00779	552791-1	1		
J11	CONNECTOR, 20-PIN, SIP	443077	00779	583773-9	1		
J12	CONNECTOR, BD EDGE, RECPT, 8-PIN	354951	00779	583407-5	1		
J13	SOCKET, 4-POS, SIP	461756	00779	583773-1	1		
J14	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	16		
J15	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
J16	CONNECTOR, 11-PIN	494666	00779	1-640456-1	1		
J17	SOCKET, IC, 24-PIN	376236	91506	324-AG39D	2		
J201	CONNECTOR, 5-PIN	417899	52072	CA-05S-TSD	1		
L1	CHOKE, 6-TURN	320911	89536	320911	1		
MP1	BRACKET, CAP REG	490490	89536	490490	1		
MP2	GROMMET, NYLON	102277	89536	102277	A/R		
MP3	INSULATOR, SEMI-CONDUCTOR MOUNTING	508630	55285	7403-09-FR-51	1		
MP4	KEY, CONNECTOR POLARIZING, (NOT SHOWN)	424572	89536	424572	1		
MP5	CABLE, TIE	501734	89536	501734	1		
MP6	HEADER, PROGRAMMED (used w/J14)	495507	51167	16-675-191	1		
P30	CONNECTOR, TEST POINT	512889	02660	62395	REF		
P32-34	CONNECTOR, TEST POINT	512889	02660	62395	REF		
P201	CONNECTING LINK	523167	89536	523167	1		
Q1	TRANSISTOR, SI, PNP	195974	04713	2N3906	1	1	
R1	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	9		
R2	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R3	RES, COMP, 4.7K +/-5%, 1/4W	148072	01121	CB4725	1		
R4	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R5	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R6	RES, DEP. CAR, 150 +/-5%, 1/4W	343442	80031	CR251-4-5P150E	1		
R7	RES, DEP. CAR, 51 +/-5%, 1/4W	414540	80031	CR251-4-5P51E	3		
R8	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R9	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	6		
R10	RES, MTL. FILM, 100K +/-1%, 1/8W	248807	91637	CMF551003F	1		
R11	RES, MTL. FILM, 681K +/-1%, 1/8W	381517	91637	CMF556813F	1		
R12	RES, MTL. FILM, 1.5K +/-1%, 1/8W	313098	91637	CMF551501F	1		
R13	RES, MTL. FILM, 10K +/-1%, 1/8W	168260	91637	CMF551002F	1		
R14	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R15	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		

Table 6-3. A2 Digital Controller PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
R16	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R17	RES, DEP. CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100KT	1		
R18	RES, MTL. FILM, 28.0K +/-1%, 1/8W	291385	91637	CMF552802F	1		
R19	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R20	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R21	RES, MTL. FILM, 82.5K +/-1%, 1/8W	246223	91637	CMF558252F	1		
R22	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R23	RES, DEP. CAR, 51 +/-5%, 1/4W	414540	80031	CR251-4-5P51E	REF		
R24	RES, DEP. CAR, 51 +/-5%, 1/4W	414540	80031	CR251-4-5P51E	REF		
R25	RES, DEP. CAR, 270 +/-5%, 1/4W	348789	80031	CR251-4-5P270E	1		
R26	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R27	RES, DEP. CAR, 750 +/-5%, 1/4W	441659	80031	CR251-4-5P750E	1		
R28	RES, COMP, 1.8K +/-5%, 1/4W	175042	01121	CB1825	1		
R101	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R102	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R103	RES, DEP. CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	1		
R104	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	1		
R105	RES, DEP. CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	REF		
R201	RES, WW, 0.1 +/-10%, 2W	485672	89536	485672	1		
R202	RES, MTL. FILM, 249 +/-1%, 1/8W	448043	91637	CMF552490F	1		
R203	RES, MTL. FILM, 649 +/-1%, 1/8W	309955	91637	CMF556490F	1		
R204	RES, VAR, 200 +/-10%, 1/2W	275743	89536	275743	1	1	
R205	RES, COMP, 2K +/-5%, 1/4W	202879	01121	CB2025	1		
R209	RES, COMP, 10K +/-10%, 1/2W	108118	01121	EB1031	1		
R210	RES, WW, 13 +/-5%, 5W	520197	89536	520197	1		
RN1	RESISTOR NETWORK	414003	89536	414003	2	1	
RN2	RESISTOR NETWORK, 10K	355305	89536	355305	1	1	
RN1C1	RESISTOR NETWORK	414003	89536	414003	REF		
S1	SWITCH, NO, SINGLE POLE, MOMENTARY CLOSE	507319	89536	507319	1	1	
S103	SWITCH, DIP, 8-POSITION	495168	95146	DYS-8	1	1	
TP1-13	CONNECTOR, TEST POINT	512889	02660	62395	22		
TP101-TP103	CONNECTOR, TEST POINT	512889	02660	62395	REF		
TP201	CONNECTOR, TEST POINT	512889	02660	62395	REF		
TP202	CONNECTOR, TEST POINT	512889	02660	62395	REF		
TR1	POSISTOR, 1/4W	681882	89536	681882	2		
TR2	POSISTOR, 1/4W	681882	89536	681882	REF		
U1⊘	IC, CMOS, DUAL & EDG TRG FF W/PRST&CLR	418830	12040	MM74C74	2	1	
U2	IC, LSTTL, QUAD 2-INPUT AND GATE	393066	01295	SN74LS08N	2	1	
U3	IC, LSTTL, HEX INVERTER OPN COLLECTOR	394536	01295	SN74LS05	2	1	
U4	IC, TTL, DUAL D-TYPE EDGE TRGRD F/F	310227	01295	SN7474N	1	1	
U5	IC, LSTTL	654442	01295	SN74LS368AN	1	1	
U6⊘	IC, NMOS, DMA CONTROLLER	650911	50088	MK3883N-4	1	1	
U8	IC, LSTTL, OCTAL & EDGE TRG D F/F W/CLR	454892	01295	SN74LS273N	1	1	
U9	IC, LSTTL, DUAL&EDGE TRG D FF W/PRST&CLR	393124	01295	SN74LS74N	3	1	
U16	IC, LSTTL, QUAD 2-INPUT NAND GATE	393033	01295	SN74LS00N	1	1	
U17	IC, LSTTL, HEX INVERTER OPN COLLECTOR	394536	01295	SN74LS05	REF		
U18⊘	IC, NMOS, 8-BIT MICROPROCESSOR	478073	50088	MK3880-4CPU	1	1	
U19	IC, TTL, HEX INVERTER	292979	01295	SN7404N	1	1	
U20	IC, LSTTL, 4-BIT SYNCCRNS BIN CNTR	495598	01295	SN74LS163N	1	1	

Table 6-3. A2 Digital Controller PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
U21Ø	IC, CMOS, DUAL 4-BIT UP COUNTER	355164	04713	MC14520BCP	2	1	
U22Ø	IC, CMOS, DUAL D FLIP-FLOP	340117	02735	CD4013AE	1	1	
U23Ø	IC, CMOS, QUAD 2-IN NAND SCMT TRIGG	404632	02735	CD4093BE	1	1	
U24	IC, LSTTL, OCTAL BUS XCVR W/3STATE	477406	01295	SN74LS245	1	1	
U25	IC, TTL, 4-16BIT DCDR W/DUAL STROBE	293217	01295	SN74154N	1	1	
U26Ø	IC, CMOS	658856	89536	658856	1	1	
U27Ø	IC, CMOS, HEX BUFFER-TRI STATE	407759	12040	MM80C97N	2	1	
U28Ø	IC, CMOS, DUAL 4-BIT UP COUNTER	355164	04713	MC14520BCP	REF		
U29	IC, LINEAR, CMOS/MOS PLL	403584	02735	CD4046AE	1	1	
U30	IC, LSTTL, QUAD 2-IN POS-NOR GT W/TP OUT	393041	01295	SN74LS02N	1	1	
U31Ø	IC, CMOS, HEX BUFFER-TRI STATE	407759	12040	MM80C97N	REF		
U32Ø	IC, CMOS, PRESETTABLE DIV BY N CNTR	478313	02735	CD4018BE	1	1	
U33	IC, LSTTL, QUAD 2-INPUT AND GATE	393066	01295	SN74LS08N	REF		
U34	IC, TTL, SCHMITT-TRIGGER INVERTER	483180	01295	SN74LS14N	2	1	
U35Ø	IC, CMOS, DUAL & EDG TRG FF W/PRST&CLR	418830	12040	MM74C74	REF		
U36	IC, LSTTL, DUAL RETRIG MONOSTAB MULTI	404186	01295	SN74LS123N	1	1	
U37	IC, TTL, DUAL AND, OPEN COLLECTOR DRVR	329706	01295	SN75452P	1	1	
U38	IC, PULSE TRANSFORMER	509141	89536	509141	1	1	
U39	IC, LSTTL, QUAD 2-IN POS-NAND SCMT TRG	504449	01295	SN74LS132N	1	1	
U1C1Ø	IC, NMOS, GEN PURPOSE INTERFACE ADAPTER	477794	04713	MC68488P	1	1	
U102	IC, LSTTL, HEX NON-INV BFR W/NOR ENABLE	429902	12040	DM81LS95N	1	1	
U1C3	IC, LSTTL, DUAL&EDGE TRG D FF W/PRST&CLR	393124	01295	SN74LS74N	REF		
U104	IC, LSTTL, QUAD 2-INPUT OR GATE	393108	01295	SN74LS32N	1	1	
U105	IC, LSTTL, DUAL&EDGE TRG D FF W/PRST&CLR	393124	01295	SN74LS74N	REF		
U106	IC, LSTTL, HEX INVERTER	393058	01295	SN74LS04N	REF		
U107	IC, LSTTL, QUAD IEEE-488 BUS XCVR	428649	04713	MC3446P	1	1	
U108	IC, QUAD, 3-STATE BUS TRANSCEIVER	453480	04713	MC3448P	3	1	
U109	IC, QUAD, 3-STATE BUS TRANSCEIVER	453480	04713	MC3448P	REF		
U110	IC, QUAD, 3-STATE BUS TRANSCEIVER	453480	04713	MC3448P	REF		
U202	IC, LIN, ADJ VOLT REGULATOR	460410	12040	LM317T	1	1	
W1	WIRE, TEFLON, JUMPER	529776	89536	529776	1		
XU1	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	19		
XU2	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU3	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU4	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU5	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU6	SOCKET, IC, 40-PIN	429282	09922	DILB40P-108	4		
XU8	SOCKET, IC, 20-PIN	454421	01295	C932002	3		
XU9	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU16	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU17	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU18	SOCKET, IC, 40-PIN	429282	09922	DILB40P-108	REF		
XU19	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU20	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU21	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU22	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU23	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU24	SOCKET, IC, 20-PIN	454421	01295	C932002	REF		
XU25	SOCKET, IC, 24-PIN	376236	91506	324-AG39D	REF		
XU26	SOCKET, IC, 40-PIN	429282	09922	DILB40P-108	REF		
XU27	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		

Table 6-3. A2 Digital Controller PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
XU28	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU29	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU30	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU31	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU32	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU33	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU34	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU35	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU36	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU37	SOCKET, IC, 8-PIN	478016	91506	308-AG39D	1		
XU38	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU39	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU101	SOCKET, IC, 40-PIN	429282	09922	DILB40P-108	REF		
XU102	SOCKET, IC, 20-PIN	454421	01295	C932002	REF		
XU103	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU104	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU105	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU106	SOCKET, IC, 14-PIN	276527	09922	DIL8P-108	REF		
XU107	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU108	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU109	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU110	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
Y1	CRYSTAL, QUARTZ, W/HC-18/U PACKAGE	485060	89536	485060	1		

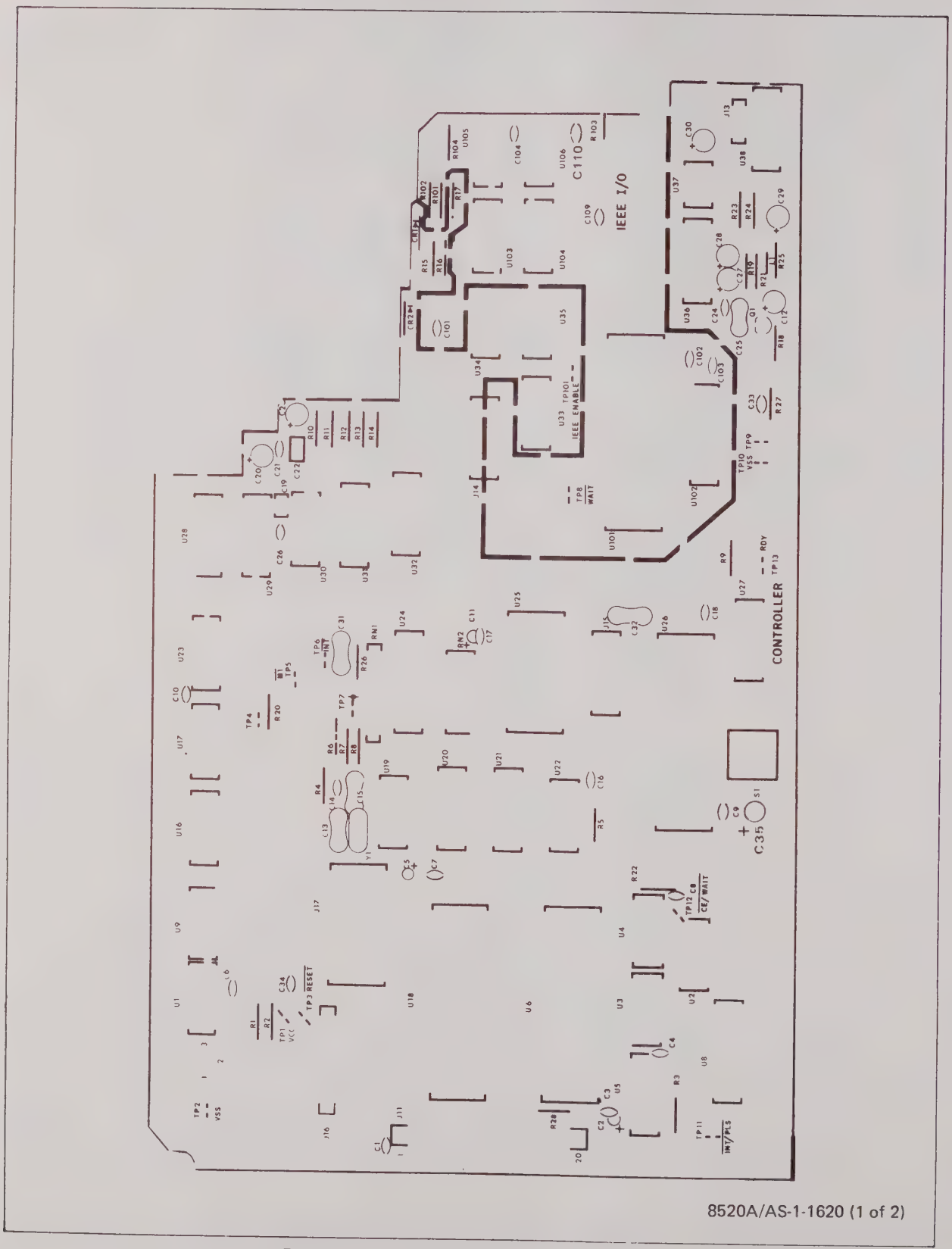


Figure 6-3. A2 Digital Controller PCB Assembly

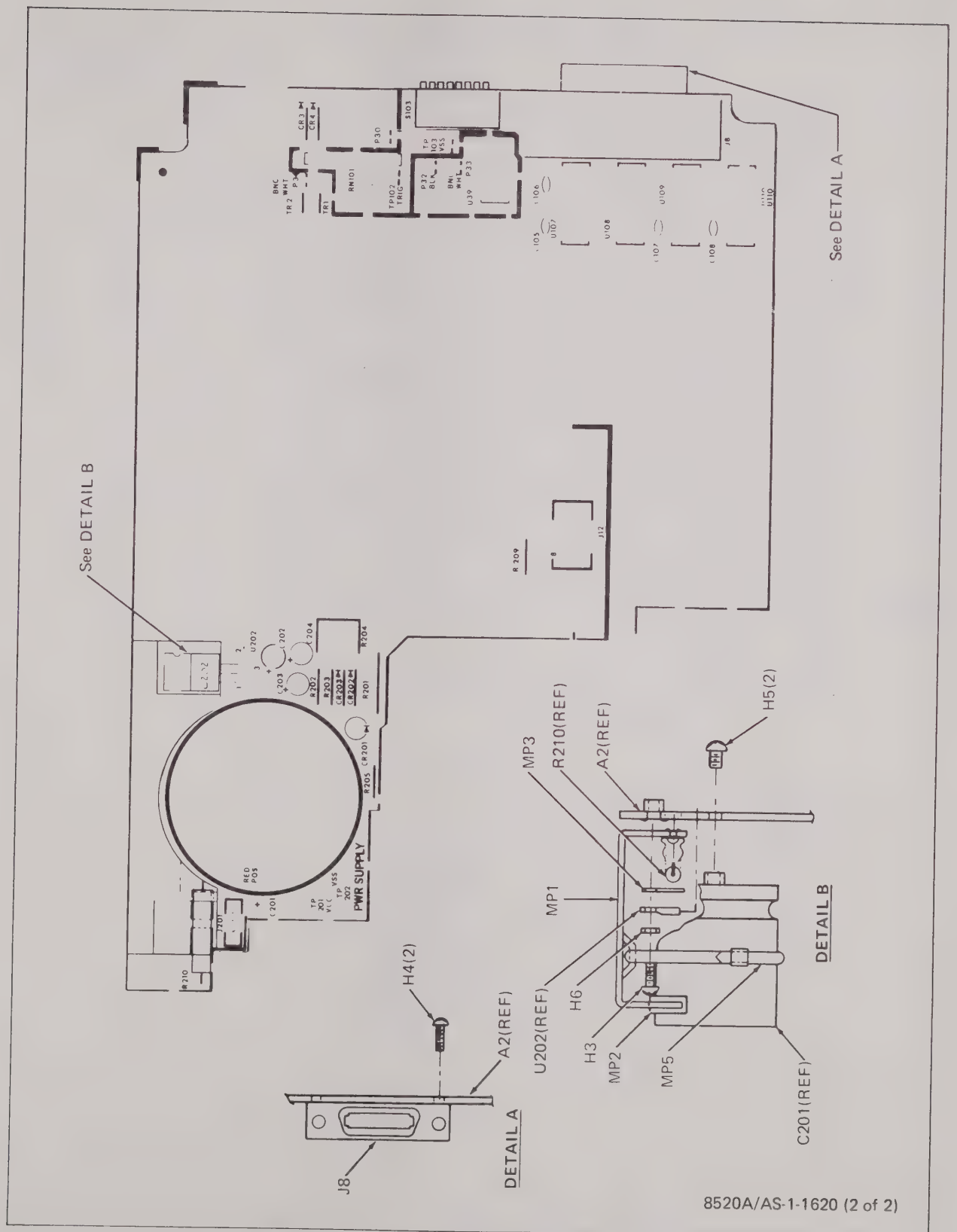


Figure 6-3. A2 Digital Controller PCB Assembly (cont)

Table 6-6a. A5 Memory Expander Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
A5Ø	MEMORY EXPANDER ASSEMBLY FIGURE 6-6a (8520A/AS-1-4093T)	745513	89536	745513	REF		
C1-C6	CAP, CER, 0.05 UF -20/+80%, 25V	148924	72982	5855-000-Y5U0-503Z	9		
C7	CAP, TA, 150 UF +/-20%, 15V	422576	56289	196D157X0020TA1	1		
C8-C10	CAP, CER, 0.05 UF -20/+80%, 25V	148924	72982	5855-000-Y5U0-503Z	REF		
H1	SCREW, PHP, 4-40 X 1/4	185918	89536	185918	2		
J1	CONNECTOR, 11-PIN	494666	00779	1-640456-1	1		
J2	SOCKET, IC, 24-PIN	376236	91506	324-AG39D	3		
MP1	HINGE, STAND-OFF	354779	89536	354779	2		
U1Ø	IC, PROM, PROGRAMMED	745554	89536	745554	1	1	
U2Ø	IC, PROM, PROGRAMMED	745562	89536	745562	1		
U3Ø	IC, PROM, PROGRAMMED	745570	89536	745570	1		
U4Ø	IC, PROM, PROGRAMMED	745588	89536	745588	1	1	
U5Ø	IC, PROM, PROGRAMMED	745596	89536	745596	1	1	
U7Ø	IC, NMOS, 2K X 8-BIT STATIC ROM	584144	89536	584144	2	1	
U8Ø	IC, NMOS, 2K X 8-BIT STATIC ROM	584144	89536	584144	REF		
U9	IC, LSTTL, 3-8 BIT DECODER W/ENABLE	407585	01295	SN74LS138N	2	1	
U10	IC, LSTTL, 3-8 BIT DECODER W/ENABLE	407585	01295	SN74LS138N	REF		
W1-W16	WIRE, TEFLON, JUMPER	529776	89536	529776	A/R		
W17	CABLE ASSEMBLY, MEMORY EXPANDER	527978	89536	527978	1		
W18	CABLE ASSEMBLY, 24 CONDUCTOR RIBBON	519140	52072	CAD24P02261CC003	1		
XU1-XU6	SOCKET, IC, 28-PIN	448217	89536	448217	6		
XU7	SOCKET, IC, 24-PIN	376236	91506	324-AG39D	REF		
XU8	SOCKET, IC, 24-PIN	376236	91506	324-AG39D	REF		
XU9	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	2		
XU10	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		

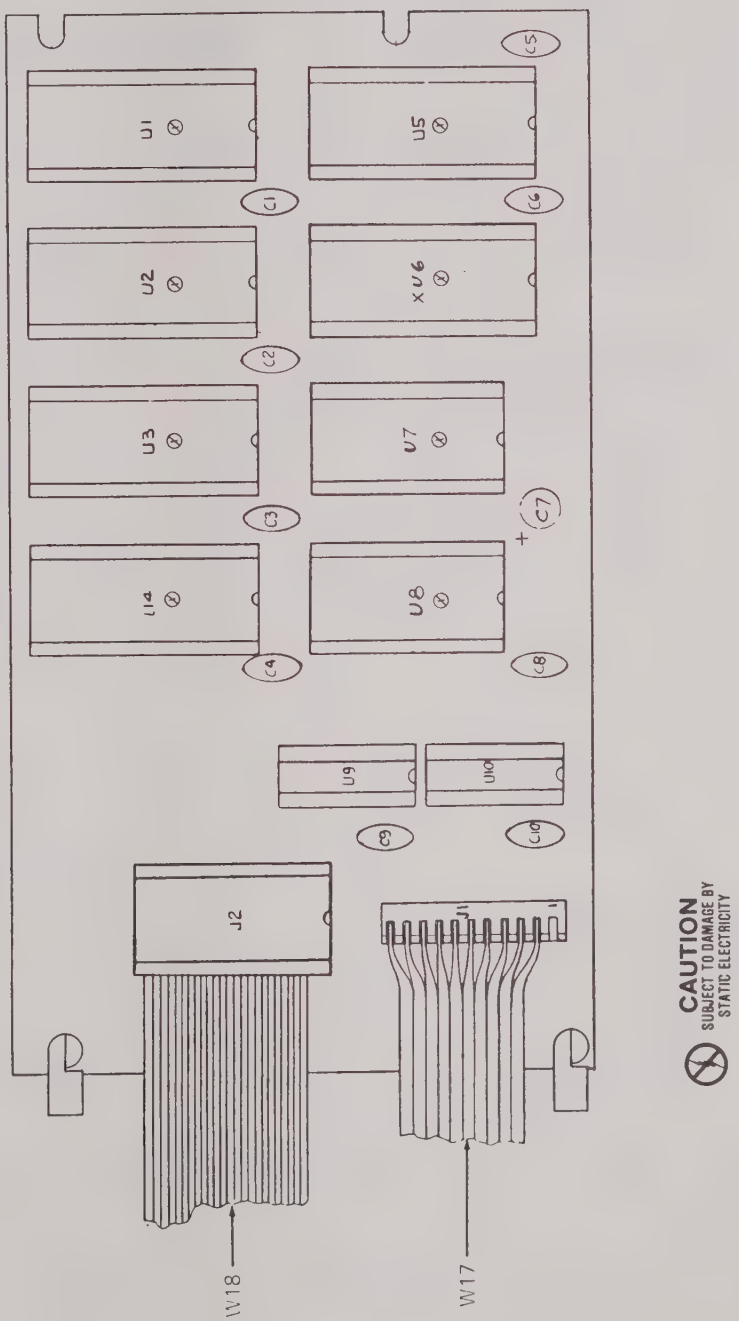


Figure 6-6a. A5 Memory Expander Assembly

Section 8
Schematic Diagrams

TABLE OF CONTENTS

In the Table of Contents, add the following item:

FIGURE	TITLE	DRAWING NO.	PAGE
8012a.	Memory Expander Assembly	8520A/AS-1-1093	Addendum

Replace the following figures in the Service Manual with the corresponding figures given in this addendum, and add Figure 8-12a.

FIGURE	TITLE	DRAWING NO.
8-1.	Assembly Placement	8520A/AS-1-1303
8-2.	Power Supply	8520A/AS-1-1023
8-4.	Digital Controller	8520A/AS-1-1021
8-5.	IEEE-488 Interface	8520A/AS-1-1022
8-12a.	Memory Expander Assembly	8520A/AS-1-1093

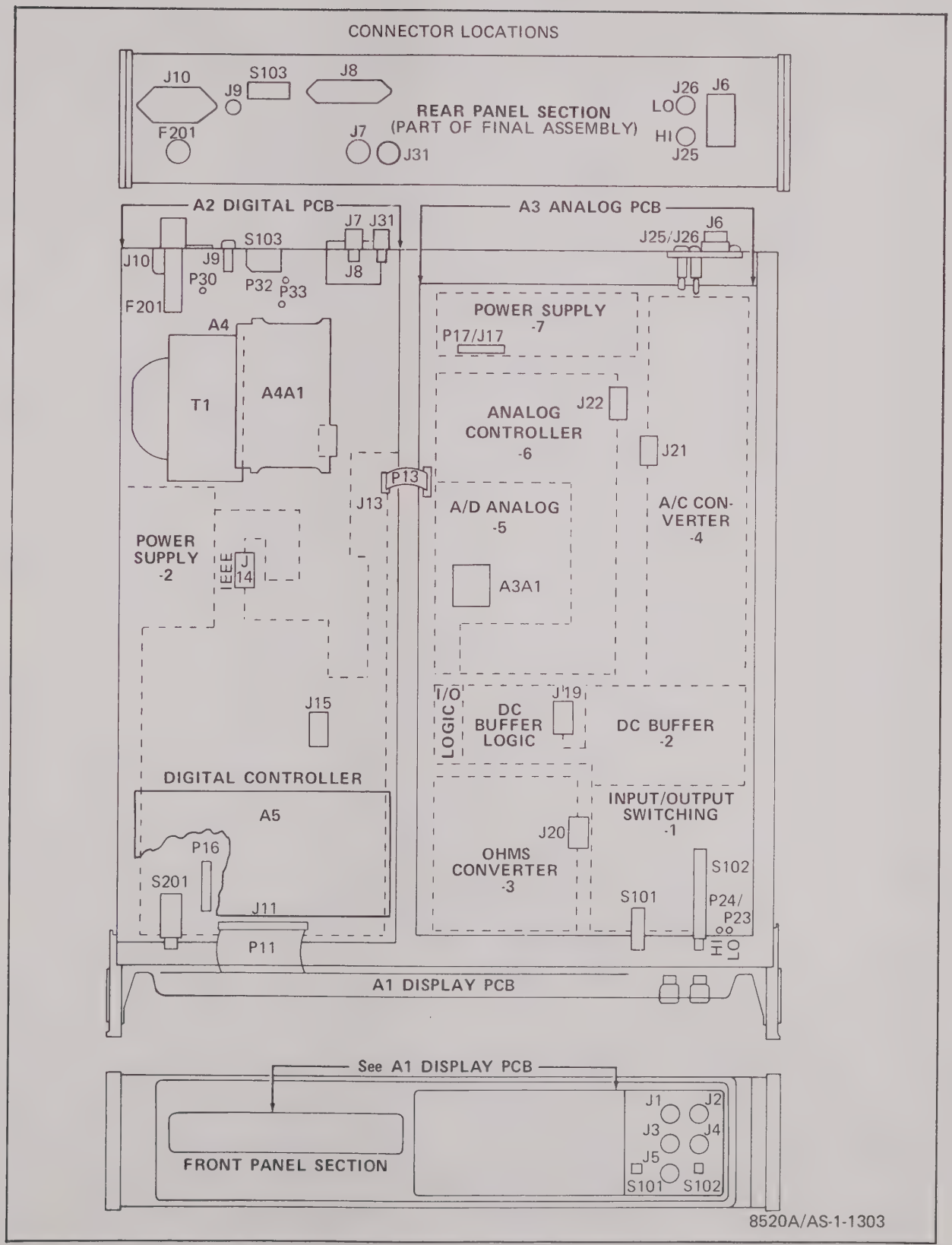
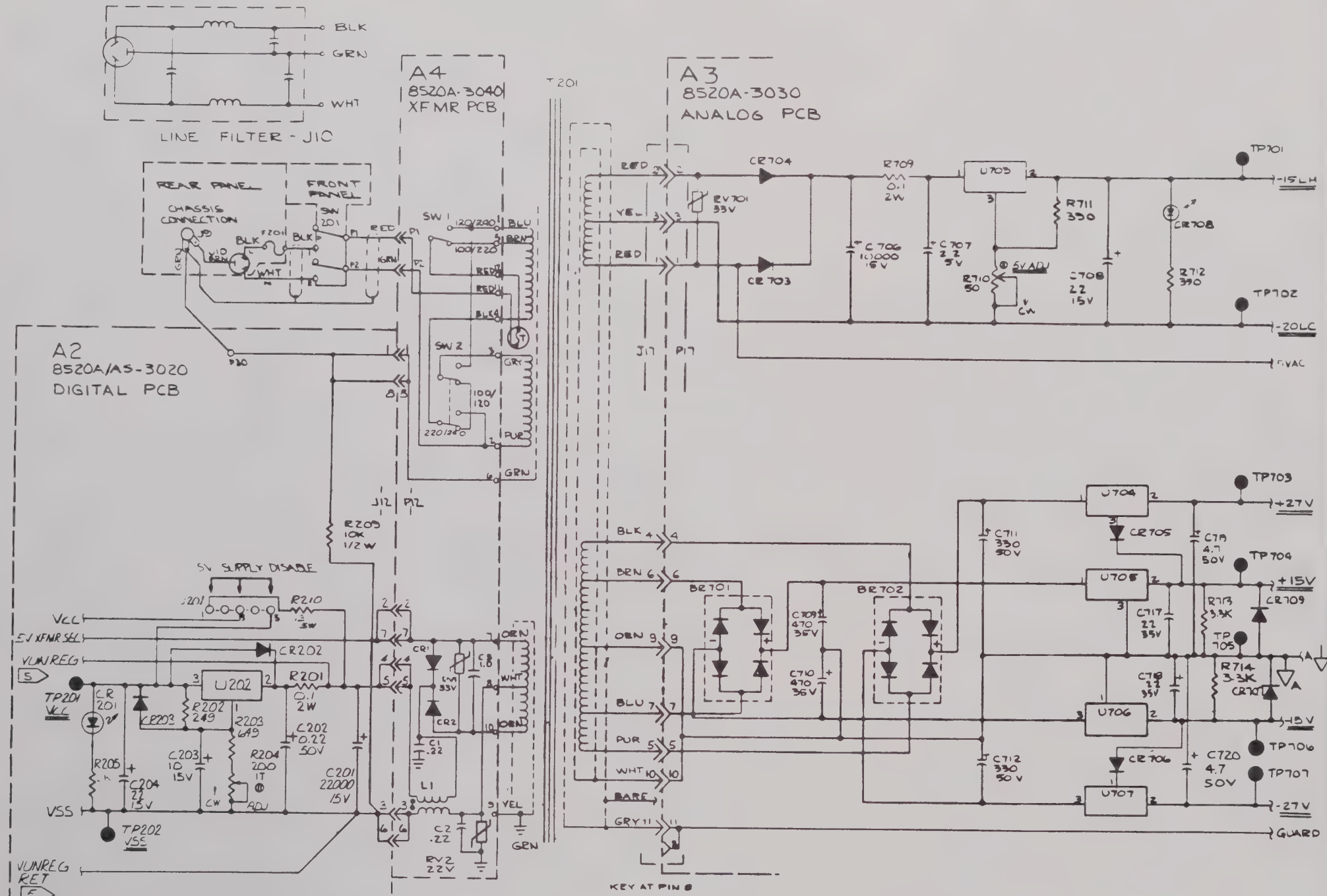


Figure 8-1. Assembly Placement

NOTES:

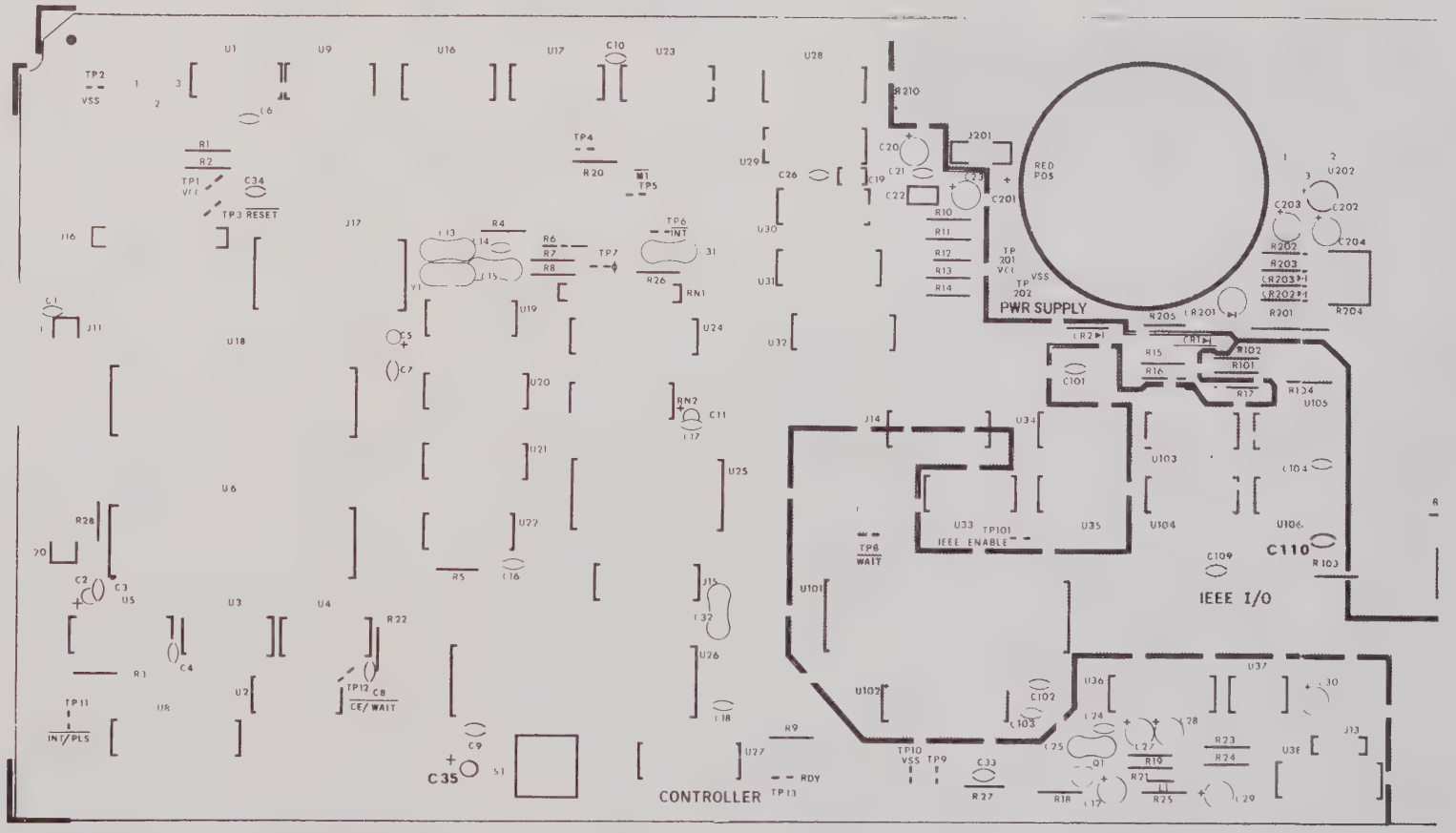


NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES IN OHMS.
2. ALL CAPACITANCE VALUES IN MICRO-FARADS.

ANALOG CONTROLLER A.C. CONVERTER OHMS DC BUFFER/I/O SW.	J10	J20	J21	J22
+27V	7	7	8	7
+15V	6	6	9	6
-15V	5	5	10	5
-15LH	4	4	11	4
-20LC	3	3	12	3
-27V	2	2	13	2
VOLTAGE	INPUT NO.			

8520A/AS-1-1023

Figure 8-2. Power Supply



Part of
8520A/AS-1-1620

Figure 8-4. Digital Controller

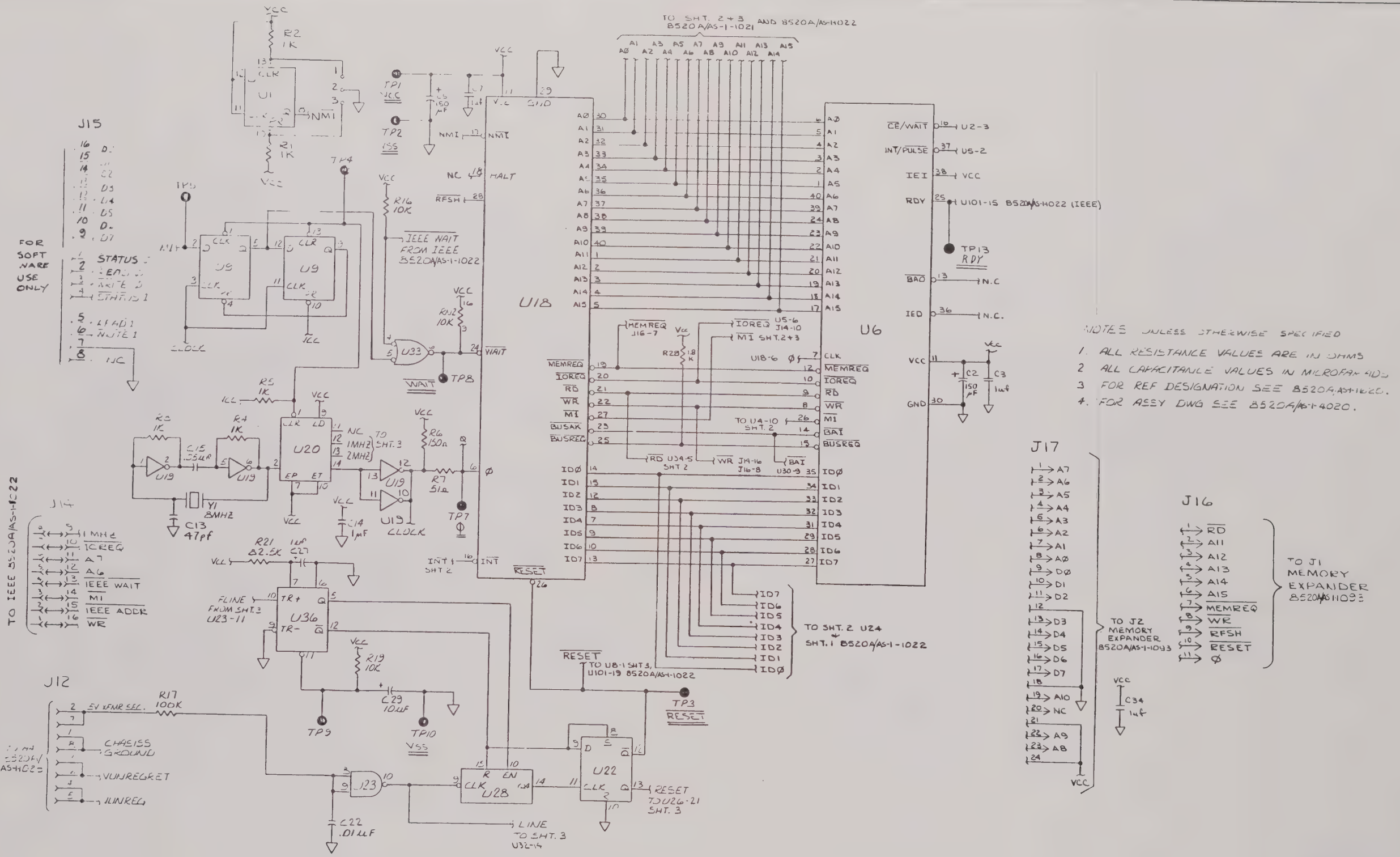
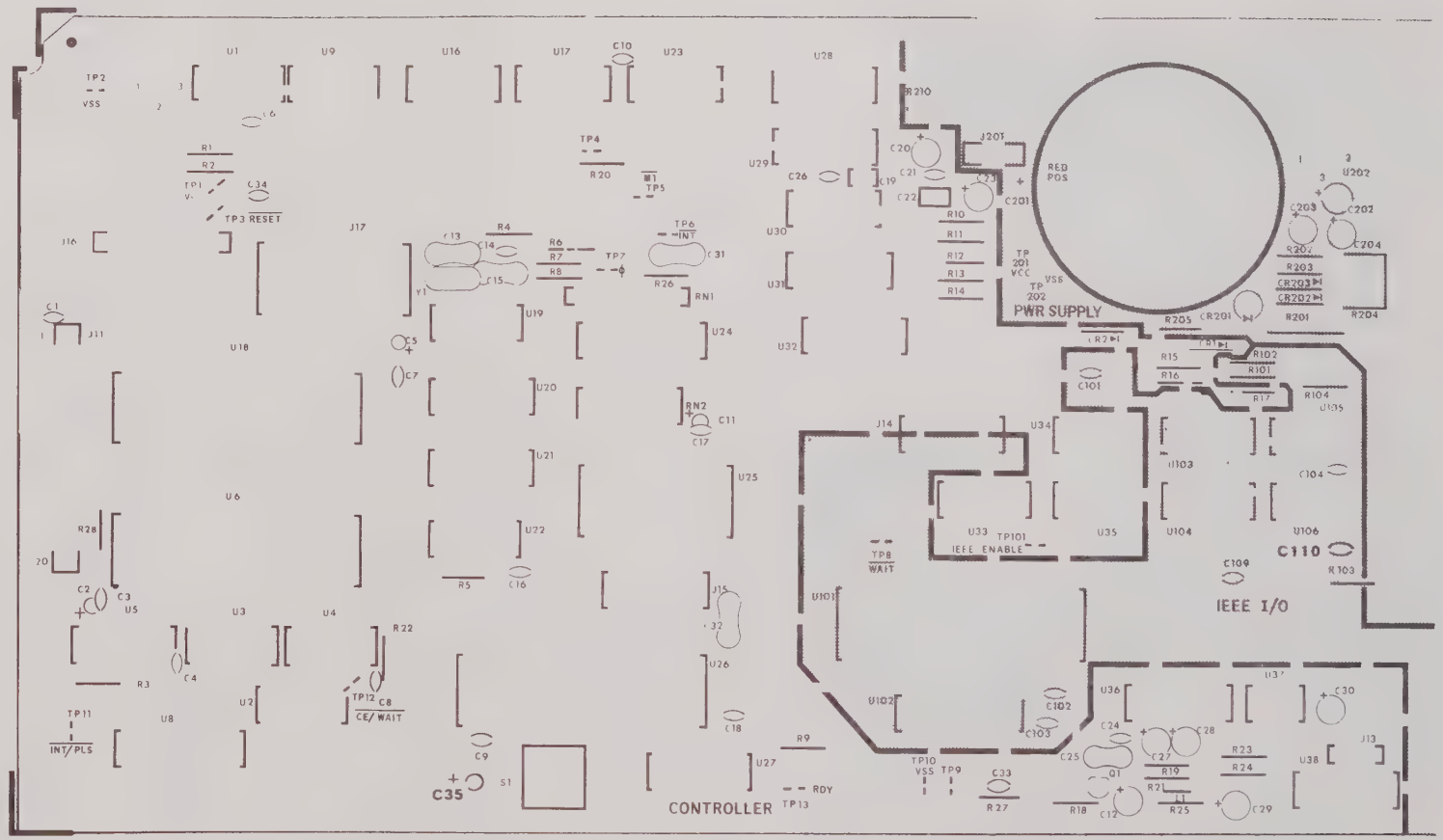
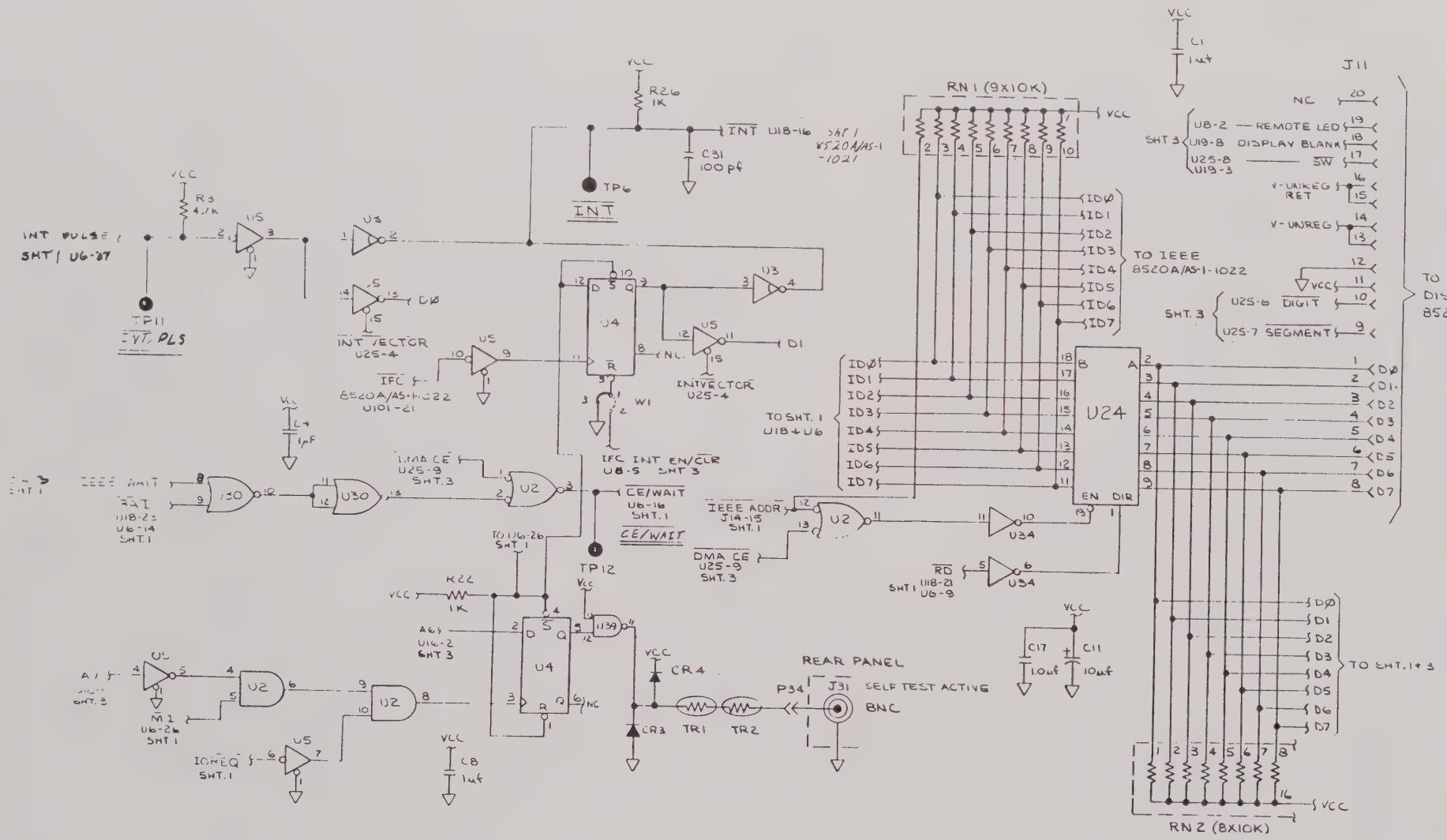


Figure 8-4. Digital Controller (cont)



Part of
8520A/AS-1-1620

Figure 8-4. Digital Controller (cont)



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL CAPACITANCE VALUES IN MICROFARADS
3. FOR REF DESIGNATION SEE 8520A/AS-1-1020.
4. FOR ASSY. DRAWING SEE 8520A/AS-1-1020

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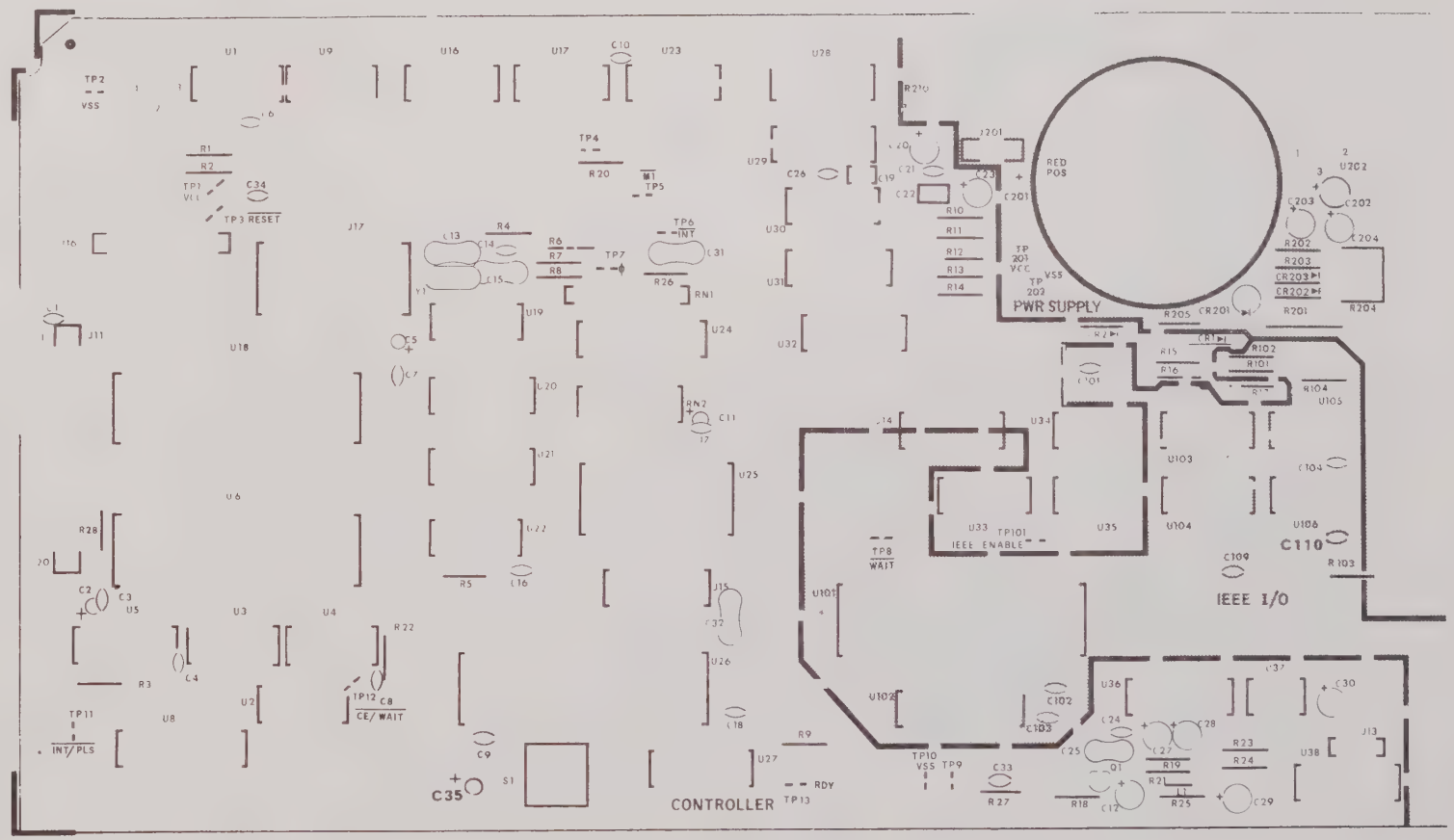
(2 of 3)

Figure 8-4. Digital Controller (cont)



Part of
8520A/AS-1-1620

Figure 8-4. Digital Controller (cont)

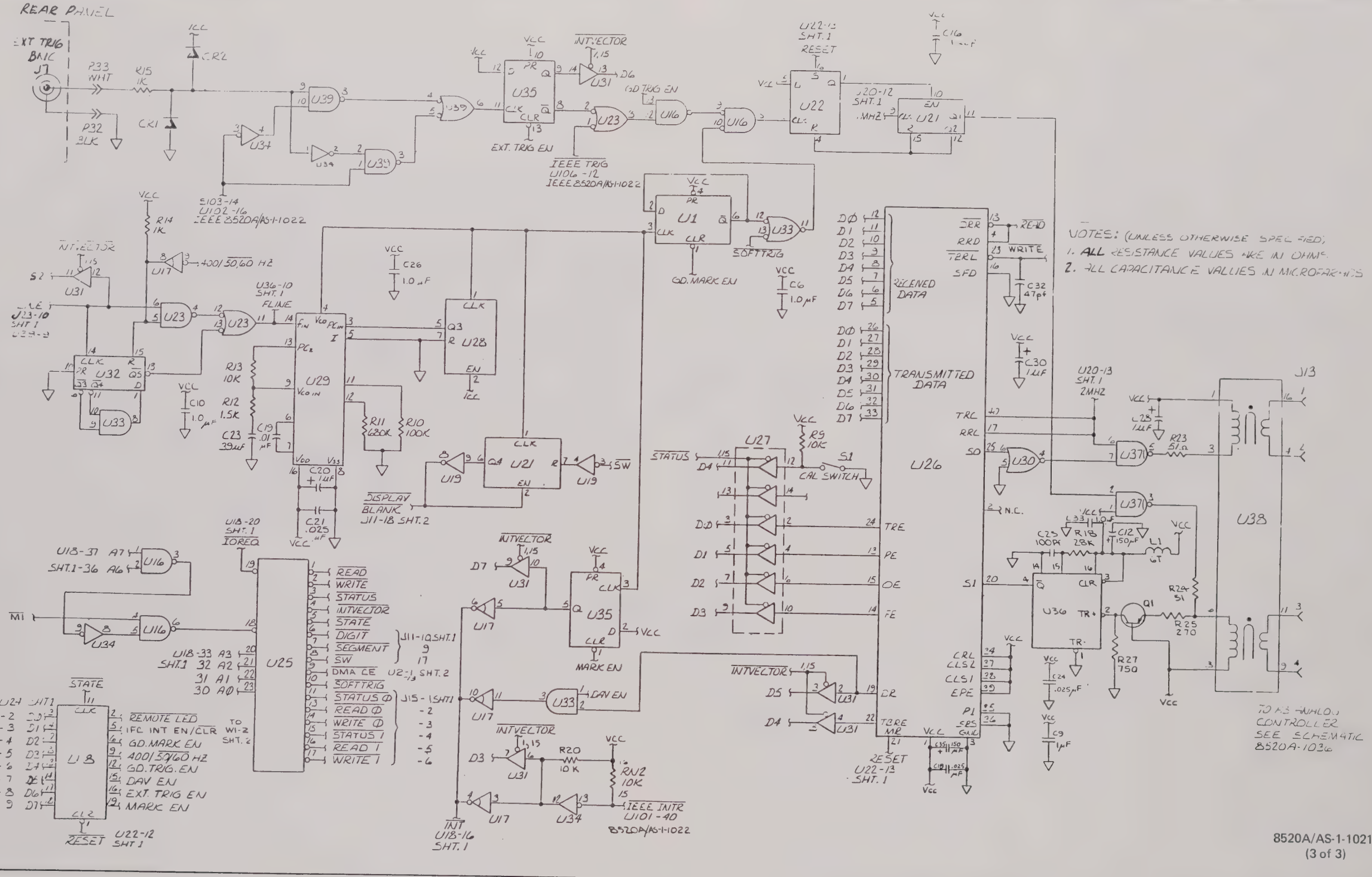
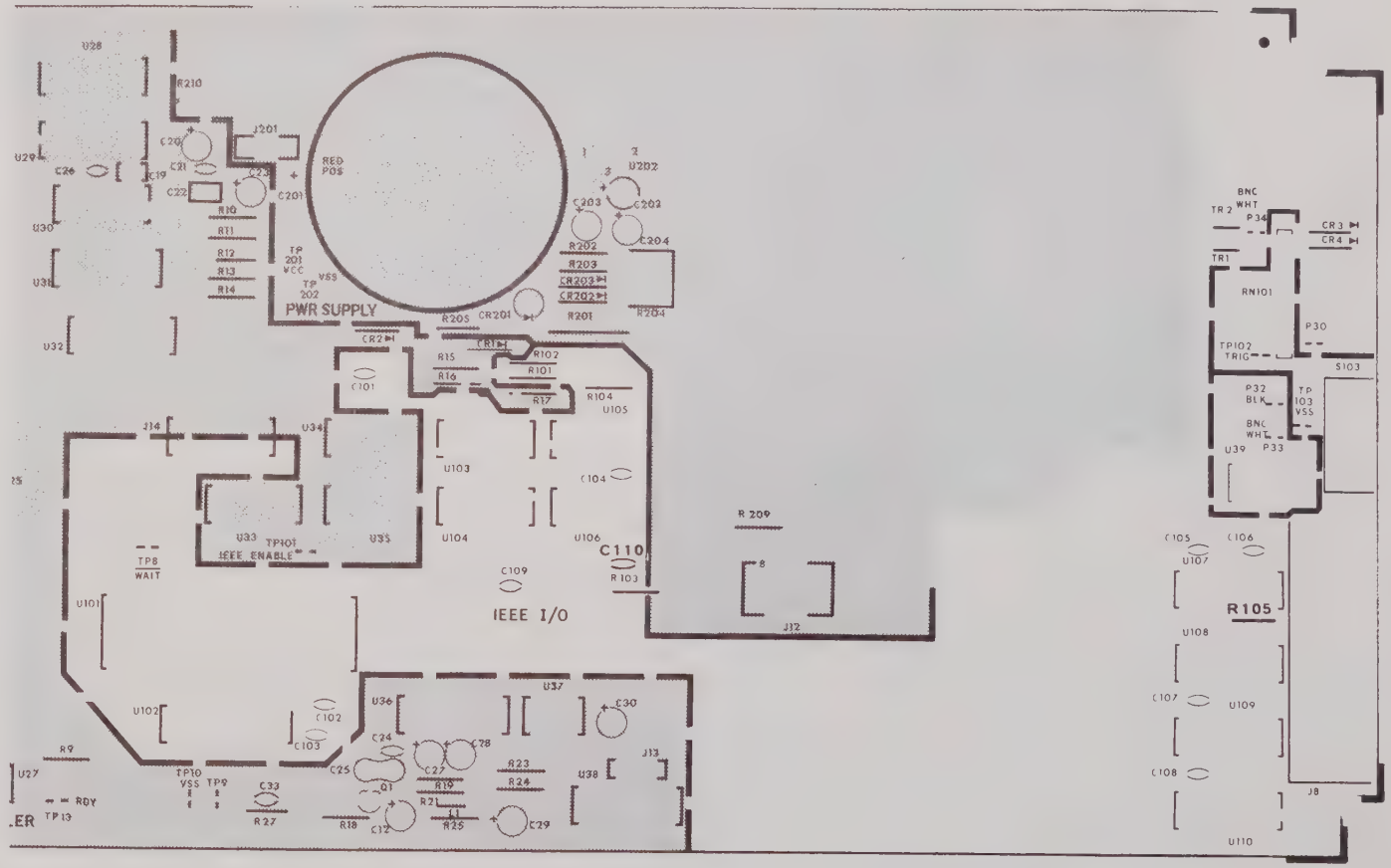
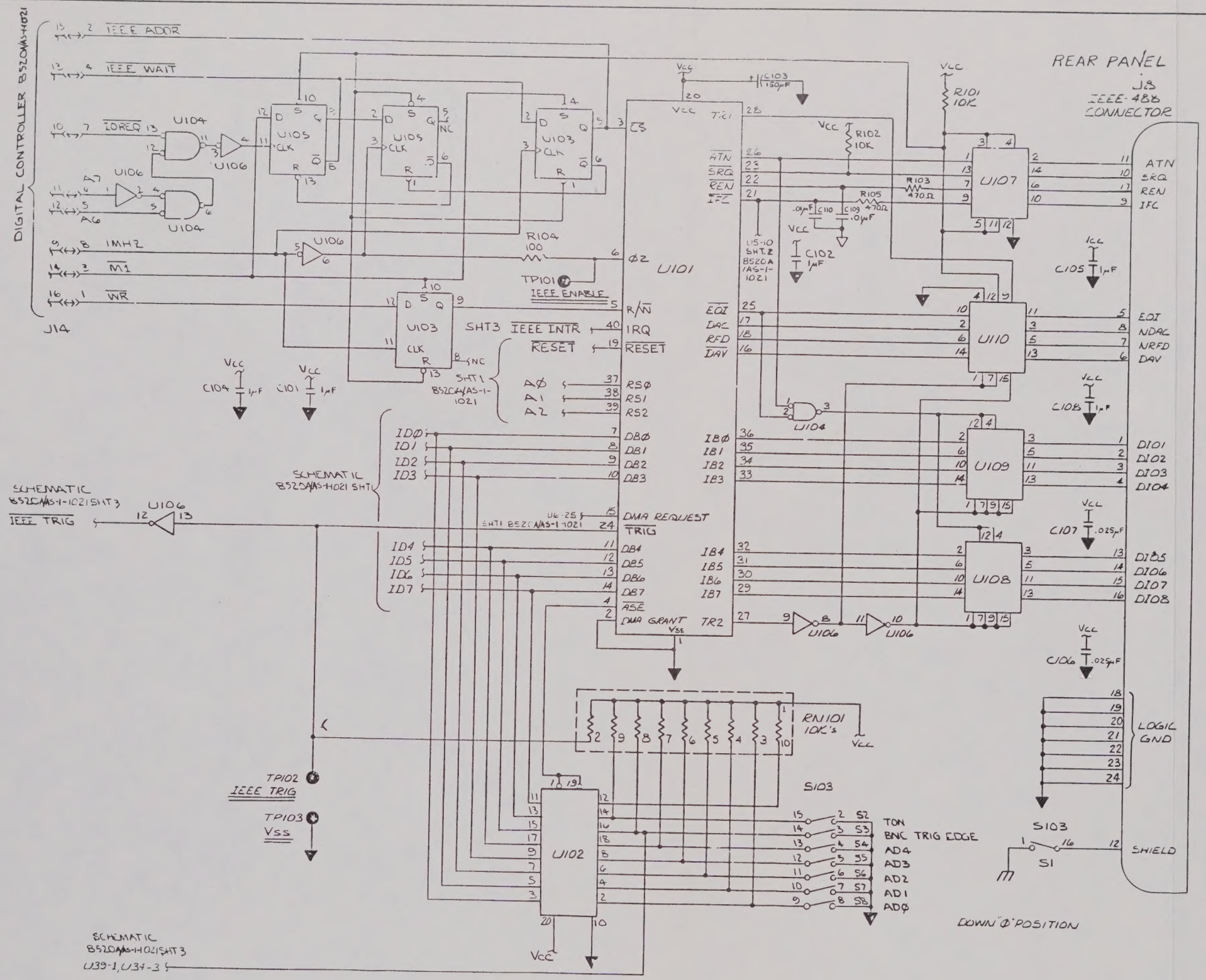


Figure 8-4. Digital Controller (cont)



Part of
8520A/AS-1-1620

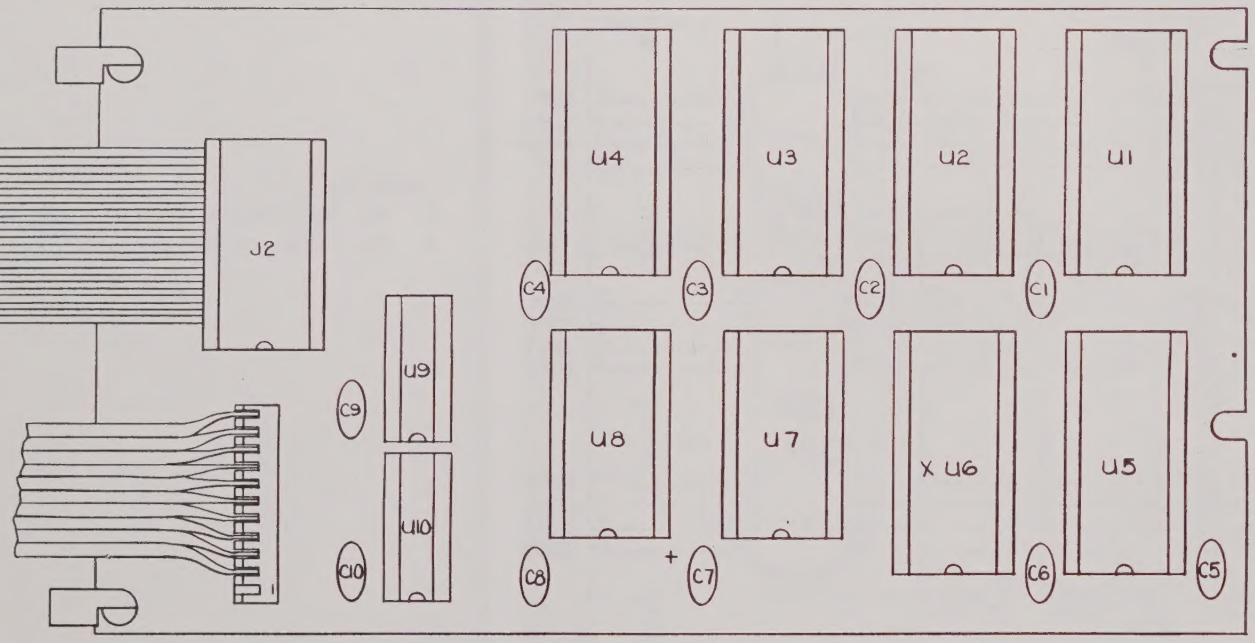
Figure 8-5. IEEE-488 Interface



NOTES:
1. ALL RESISTANCE VALUES ARE IN OHMS.
2. ALL CAPACITANCE VALUES IN MICROFARADS.

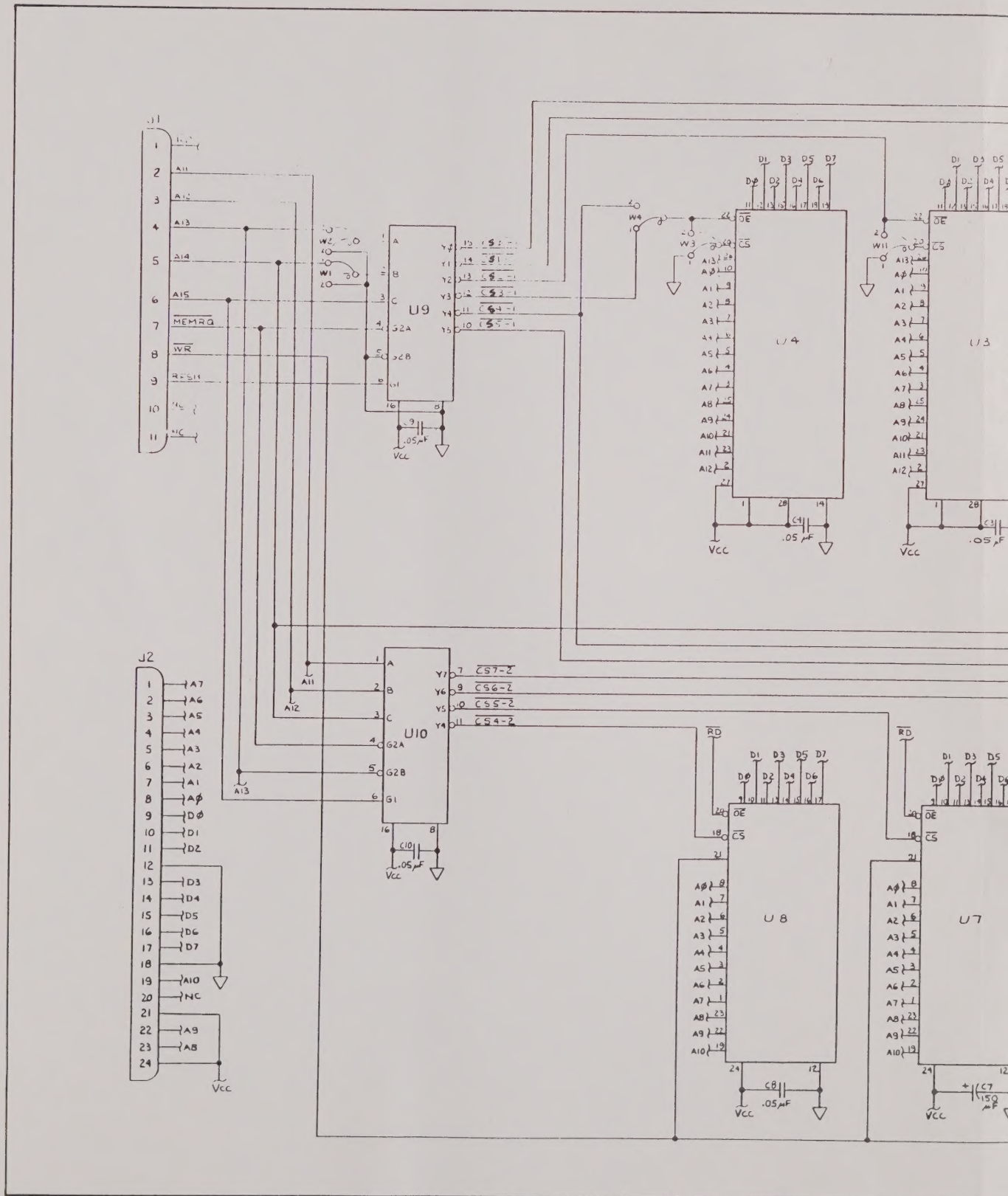
8520A/AS-1-1022

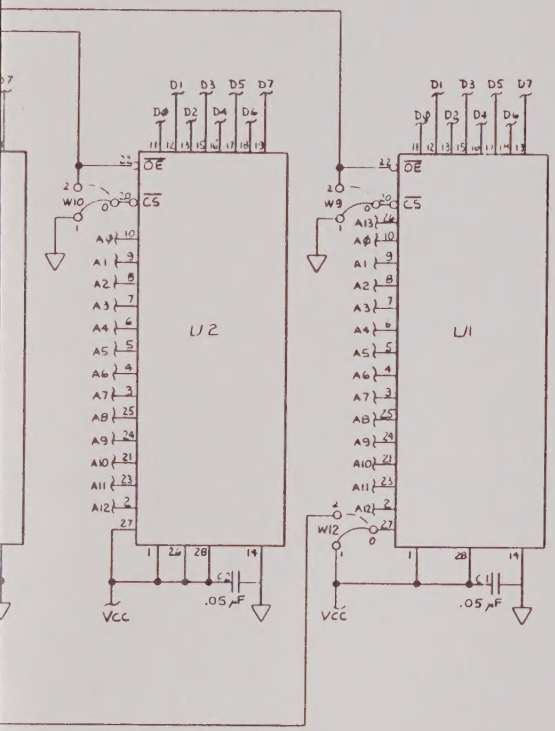
Figure 8-5. IEEE-488 Interface (cont)

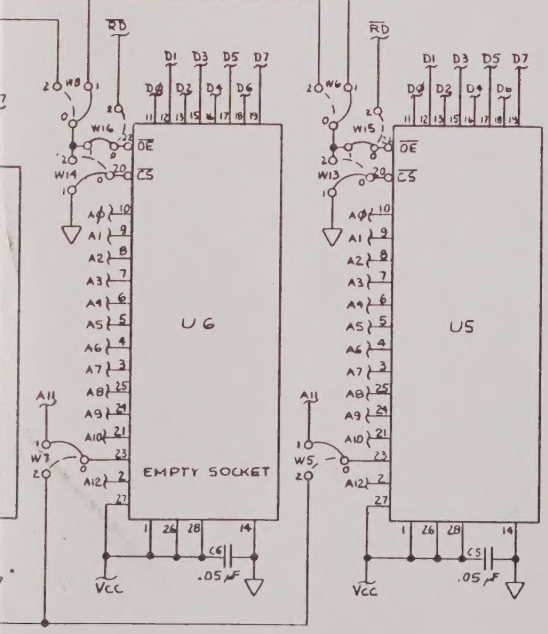


8520A/AS-1-1693

Figure 8-12a. Memory Expander Assembly


J1
A11
A12
A13
A14
A15
MEMRQ
WR
RESET
U9
W1
W2
W3
W4
W11
U4
U3
U8
U7
U10
J2
A7
A6
A5
A4
A3
A2
A1
A0
D0
D1
D2
D3
D4
D5
D6
D7
A10
NC
A9
A8
Vcc
.05 μF
RD





8520A/AS-1-1093

Figure 8-12a. Memory Expander Assembly (cont)